INSTRUCTION MANUAL
DIFFERENCE DATA ADDENDUM

MODULAR MICROWAVE
SIGNAL GENERATORS
MODELS 1105E-T AND 1106E-T

d polarad polarad **polarad** po

Polarad Electronics, Inc. 5 Delaware Dr. Lake Success N.Y. 11042 Tel: 516-328-1100 TWX: 510-223-0414

MAY 1983

Warranty

polarad electronics, inc.

We warrant each new instrument to be free of defects in materials and workmanship.

We will service, repair and adjust as required any instrument which proves defective within one year after date of delivery and which is returned to our factory (or other authorized depot) for that purpose.

For warranty information or other assistance, please contact Polarad Customer Service Department in Lake Success, New York, or an authorized regional service depot.

No other warranty is expressed or implied. No liability is assumed for consequential damages.

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DIFFERENCE DATA ADDENDUM
FOR
MODULAR MICROWAVE SIGNAL GENERATORS
MODELS 1105E-T AND 1106E-T

1-1. SCOPE OF DIFFERENCE DATA ADDENDUM

1-2. This Difference Data Addendum describes Modular Microwave Signal Generators Models 1105E-T and 1106E-T manufactured by Polarad Electronics, Inc. With the exception of the differences described in this Difference Data Addendum, the Modular Microwave Signal Generators Models 1105E-T and 1106E-T are identical to Modular Microwave Signal Generators Models 1105E and 1106E respectfully.

1-3. Models 1105E-T and 1106E-T have reverse power protection and the frequency range of Model 1106E-T is 1.8 to 4.5 GHz.

1-4. PURPOSE AND USE OF THE INSTRUMENTS

1-5 The purpose and use of Models 1105E-T and 1106E-T are the same as the purpose and use of Models 1105E and 1106E, except that the Model 1106E-T has an internally mounted ferrite isolator and the Model 1105E-T has a special high power R.F. Attenuator probe to avoid equipment damage because of reverse power when testing high power devices such as pulsed radars.

1-6. EQUIPMENT SUPPLIED

1-7. The equipment supplied with Models 1105E-T and 1106E-T are identical to the equipment supplied with Models 1105E and 1106E, except as listed below.

Substitute Model 1105E-T for Model 1105E
Substitute Model 1106E-T for Model 1106E

1-8. EQUIPMENT SPECIFICATIONS

1-9. SPECIFICATIONS WITH INTERNAL PROTECTION. The specifications for Models 1105E-T and 1106E-T are identical to the specifications listed in Table 1-2, EQUIPMENT SPECIFICATIONS of the Model 1105E and 1106E instruction manual except for the changes and additions listed below.

Characteristic	Specification
Frequency Range	
Model 1105E-T	0.8 to 2.4 GHz
Model 1106E-T	1.8 to 4.5 GHz
Uncalibrated RF Output	⩾+9 dBm at rated frequency range of signal generator
Reverse Power Protection:	
Model 1105E-T	Special high power probe. Up to 2 watts avg. (CW) and 1000 watts peak power into RF OUTPUT connector within frequency range
Model 1106E-T	Up to 5 watts avg. (CW) and 1000 watts peak power into RF OUTPUT connector within frequency range.

1-10. SCHEMATIC DIAGRAM

1-11. In figures 5-1 and 5-2 of the Instruction Manual for the Model 1106E, replace the RF OUTPUT circuit with that shown in figure 1-1 of this Difference Data Addendum.

1-12. PARTS LIST

1-13. Refer to Table 6-2 of the Instruction Manual for the Models 1105E and 1106E and change as follows:

MODELS 1105E-T AND 1106E-T PARTS LIST ADDITIONS AND CHANGES

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	QTY
IS1	FERRITE ISOLATOR 1.8 to 4.5 GHz (MODEL 1106E-T ONLY)	B162127	82199	1
1W9	POWER SET PROBE (MODEL 1105E-T ONLY)	C161343	82199	1
1W15	ATTENUATOR PROBE (MODEL 1105E-T ONLY)	C161340	82199	1
1W23	RF ATTENUATOR PROBE (MODEL 1106E-T ONLY)	B161711-1	82199	1
1W24	RF OUTPUT CABLE (MODEL 1106E-T ONLY)	B161711-2	82199	1

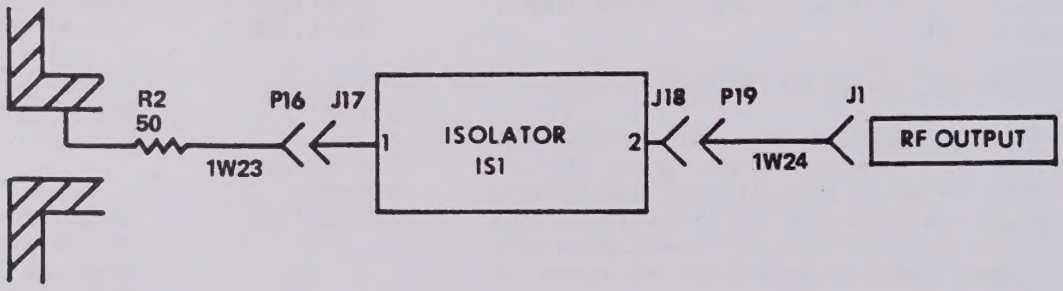

Figure 1-1. Schematic Diagram (Model 1106E-T Only)

INSTRUCTION MANUAL

MODULAR MICROWAVE SIGNAL GENERATORS MODELS 1105E-L, 1105E, 1106E-L, 1106E and MODULAR MICROWAVE SIGNAL SOURCES MODELS 1205E, 1206E

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Polarad Electronics, Inc. 5 Delaware Dr. Lake Success N.Y. 11042 Tel: 516-328-1100 TWX: 510-223-0414

APRIL 1984

Instrumentation

Warranty

polarad electronics inc.

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INSTRUCTION MANUAL CHANGE BULLETIN

THIS BULLETIN APPLIES TO:
MODEL(S): 1105E, 1105E-L, 1106E, 1106E-L, 1205E, 1206E
SERIAL NO.: All
ISSUE DATE: August 1984

Page 5-13, Figure 5-6: Change part number of CR5—CR8 and CR9—CR12 from "SH30F" to "CG3F."

Page 6-2, Table 6-1: Delete manufacturer 14099 and add the following:

Code	Name and Address
59635	H. V. Components, Inc. Howell, N.J. 07731

Page 6-7, Table 6-2: Change part number of A5A1C12 from "503D107G0" to "503D107M025."

Page 6-8, Table 6-2: Change part number of A5A1CR9 and A5A2CR5 from "SH30F" to "CG3F" and manufacturer's code from "14099" to "59635."

This bulletin should be carefully examined since it contains information vital for updating this manual and for incorporating changes made after publication date. Bulletins are issued to insure that the manual contains current information and reflects the characteristics of the instrument for which it is intended.

For additional information, please contact Polarad's instrument application specialists for maintenance assistance, or our Customer Service Department.

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INSTRUCTION MANUAL CHANGE BULLETIN

THIS BULLETIN APPLIES TO:

MODEL(S): 1105E,1106E
SERIAL NO.: All
ISSUE DATE: January 1984

A new mechanical stop has been developed and used for the attenuator dial to guarantee full mechanical stop of the attenuator probe assembly. This will prevent breaking of the klystron tube with the attenuator probe.

Page 4-18, Paragraph 4-16. Delete entire paragraph and replace with the following:

4-16. REPLACEMENT OF ATTENUATOR PROBE ASSEMBLY

For Models 1105E-L and 1106E-L, proceed to paragraph 4-27. To replace the attenuator probe assembly on all other units, proceed as follows:

a. Rotate ATTENUATOR control fully clockwise.

b. Insert the probe tip through the probe collar and into the attenuator barrel, orienting the probe so that the scribe line is aligned with the scribe line on the barrel, to ensure that the ground stub is properly oriented (see paragraph 4-13e). The probe of the Model 1106E and 1206E is oriented so that the ground stub on the tip faces the rear. For Models 1105E and 1205E orientation of the probe is not necessary. Tighten the setscrews on the probe collar.

c. Mount and fasten RF OUTPUT connector J5.

d. Replace cable clamp.

e. Connect microwave power meter to the instrument (fig. 4-1, test setup B) and check maximum power output across the frequency range. If the power is below specification, it might be necessary to rotate or change the klystron tube. Be sure to check pulsing after maximum power is obtained.

f. Tune the generator to the midpoint of its frequency range, and rotate the ATTENUATOR control counter-clockwise until RF output is 0 dBm.

g. Loosen the setscrews on the attenuator dial hub and rotate the sliding dial to line up 0 dBm marking on the dial with the power set hairline.

h. Tighten the setscrews on the attenuator dial hub.

i. Tune the signal generator across the entire frequency range. Note the highest and lowest output points with reference to 0 dBm.

j. Using the two reference points measured in step i, adjust the output accuracy at 0 dBm (release setscrew and slide attenuator dial) so that the two reference points are equidistantly centered around 0 dBm.

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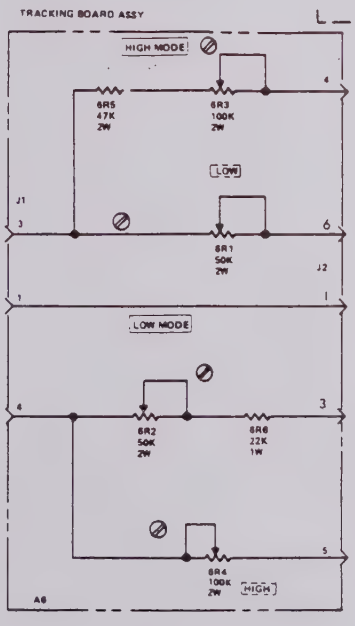
INSTRUCTION MANUAL CHANGE BULLETIN

THIS BULLETIN APPLIES TO:

MODEL(S): 1105E, 1105E-L, 1106E, 1106E-L, 1205E, 1206E
SERIAL NO.: All
ISSUE DATE: November 1983

Page 5-3, Figure 5-1; Page 5-5, Figure 5-2; Page 5-7, Figure 5-3: Change Tracking Board Assy A6 terminal number designations as shown below:



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INSTRUCTION MANUAL CHANGE BULLETIN

THIS BULLETIN APPLIES TO:

MODEL(S): 1105E, 1105E-L, 1106E, 1106E-L, 1205E, 1206E

SERIAL NO.: All

ISSUE DATE: February 10, 1983

Page 6-6, Table 6-2. Parts List: Change Part Number of A3A2R38A/B to 70D1N048F253W.

This bulletin should be carefully examined since it contains information vital for updating this manual and for incorporating changes made after publication date. Bulletins are issued to insure that the manual contains current information and reflects the characteristics of the instrument for which it is intended.

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INSTRUCTION MANUAL CHANGE BULLETIN

THIS BULLETIN APPLIES TO:

MODEL(S): 1105E, 1105E-L, 1106E, 1106E-L, 1205E, 1206E

SERIAL NO.: All

ISSUE DATE: August 1983

Page 5-9, **Figure 5-4**: Change part number of CR13 from "SH-30F" to "CG-3F".

Page 6-4, **Table 6-2**: Change part number of A3A1CR13 from "SH-30F" to "CG-3F".

This bulletin should be carefully examined since it contains information vital for updating this manual and for incorporating changes made after publication date. Bulletins are issued to insure that the manual contains current information and reflects the characteristics of the instrument for which it is intended.

For additional information, please contact Polarad's instrument application specialists for maintenance assistance, or our Customer Service Department.

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SECTION I

INTRODUCTION

1-1. SCOPE OF MANUAL

1-2 This manual contains instructions for use and maintenance of the Modular Microwave Signal Generators, Models 1105E, 1106E, 1105E-L and 1106E-L and Modular Microwave Signal Sources, Models 1205E and 1206E (figure 1-1), manufactured by Polarad Electronics, Inc., Lake Success, New York. The manual includes a general description of these instruments, operating instructions, theory of operation, maintenance data, and a parts list.

1-3. PURPOSE AND USE OF INSTRUMENTS

1-4. SIGNAL GENERATORS, MODELS 1105E AND 1106E. The frequency range of Model 1105E is 0.80 to 2.40 GHz and the frequency range of Model 1106E is 1.80 to 4.60 GHz. The ratings for uncalibrated power output is at least 10 mW for both Models throughout their frequency ranges. The range of the calibrated attenuator is +3 to −127 dBm with an absolute accuracy of ±2 dB. Typically more than rated power is available. However, when the ATTENUATOR control is adjusted for more than the rated output levels, it is possible to overcouple the pickup probe, causing minor frequency shifts and, with excessive overcoupling, reduction of power output.

1-5. The Modular Microwave Signal Generators, Models 1105E and 1106E incorporate provisions for external motor drive. The tuning shaft is located in the rear of the instruments for this purpose.

1-6. The Modular Microwave Signal Generators, Models 1105E and 1106E, incorporate phase lock provisions to increase their frequency stability when used with an

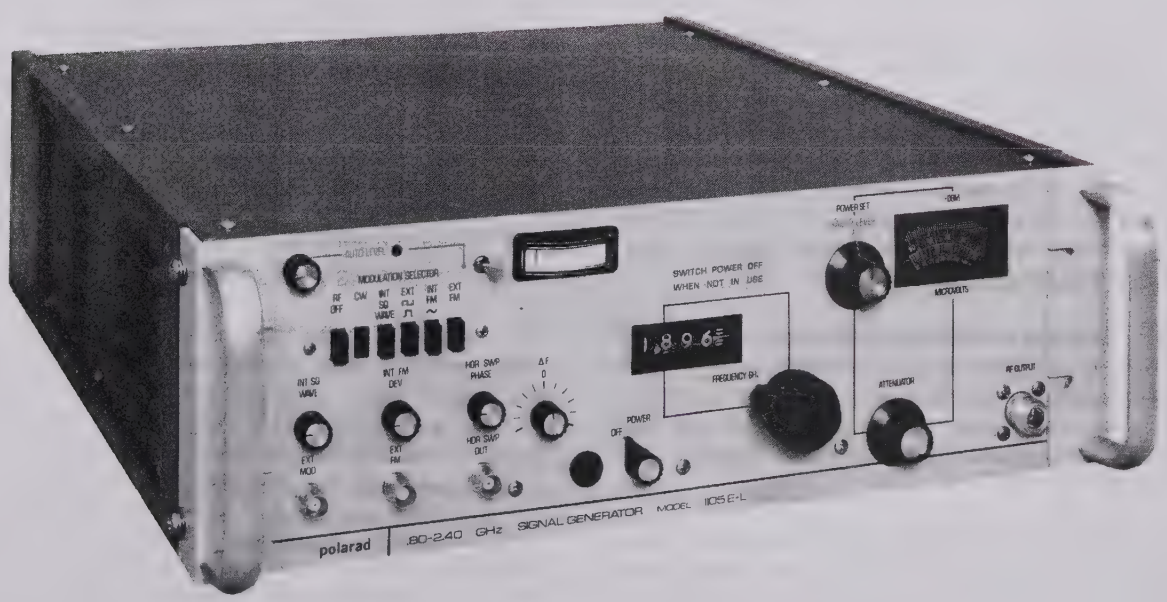


Figure 1-1. Modular Microwave Signal Generator Model 1105E-L

external oscillator synchronizer such as the Polarad Model 3815S.

1-7. Typical uses of the signal generators are testing broad- and narrow-band microwave systems and components such as antennas, attenuators, beacons, crystal mounts, hybrid junctions, preselectors, radars, receivers, and traveling wave tube amplifiers. These instruments can also be used to make specific measurements of bandwidth, attenuation, alignment, frequency dial calibration, image rejection, sensitivity, power gain, VSWR, and other characteristics. They can also be used as a receive local oscillator, modulated transmitter, or system microwave reference in checkout equipment.

1-8. SIGNAL GENERATORS, MODELS 1105E-L AND 1106E-L. The Models 1105E-L and 1106E-L Modular Microwave Signal Generators are essentially identical to the corresponding Models 1105E and 1106E Modular Microwave Signal Generators, differing in the fact that the Models 1105E-L and 1106E-L incorporate automatic leveling circuits that maintain power output at a constant level at a particular attenuator setting throughout the frequency range of each instrument. The Modular Microwave Signal Generators, Models 1105E-L and 1106E-L can be used for the same purposes as the Models 1105E and 1106E, respectively, but with greater flexibility and ease of operation.

1-9. SIGNAL SOURCES, MODELS 1205E AND 1206E. The Models 1205E and 1206E signal Sources provide a maximum power output over their frequency ranges as shown in figure 1-2. The Signal Sources differ from the Models 1105E and 1106E Signal Generators in that their attenuators are not calibrated and their output impedances are very low. The frequency ranges of the Signal Sources are identical with those of the corresponding Models 1105E and 1106E Signal Generators.

1-10. Typical uses of the Signal Sources are in the investigation of antenna patterns and characteristics, measurement of attenuation, gain, insertion loss, Q, selectivity, frequency and signal-to-noise ratio. They can also be used for alignment of communication and radar systems and components.

1-11. The Modular Microwave Signal Generators, Models 1105E/1105E-L, 1106E and 1106E-L and Signal Sources, Models 1205E and 1206E, incorporate phase lock provisions to increase their frequency stability when used with an external oscillator synchronizer. They incorporate provisions for external motor drive. The tuning shaft extends through the rear of the instruments for this purpose.

1-12. GENERAL DESCRIPTION

1-13. The Modular Microwave Signal Generators, Models 1105E, 1106E, 1105E-L, and 1106E-L, and the Modular Microwave Signal Sources, Models 1205E and 1206E (hereinafter referred to by model number) are identically sized, self-contained, compact instruments suitable for bench or rack use. The instruments are line-powered and consist of a panel, a frame or chassis, and dust cover. The panel serves as a mounting for the controls and connectors. The handles at either end of the panel are reversible for bench or rack use. The dust covers, which are side, top, and bottom panels, enclose and protect the internal components of the instrument.

1-14. EQUIPMENT SUPPLIED

1-15. Table 1-1 lists the equipment supplied for the instruments.

1-16. EQUIPMENT SPECIFICATIONS

1-17. Table 1-2 lists the equipment specifications for the Models 1105E/1105E-L, 1106E/1106E-L, 1205E and 1206E instruments.

1-18. TRANSISTORS, DIODES, INTEGRATED CIRCUITS AND KLYSTRON COMPLEMENT

1-19. Table 1-3 lists the transistors, diodes, integrated circuits and klystron complements of Models 1105E/1105E-L, 1106E/1106E-L, 1205E, and 1206E.

1-20. ACCESSORIES FOR POLARAD SIGNAL GENERATORS AND SOURCES

1-21. The Polarad Model 1020A Modulator is a solid state function generator which provides adjustable, well-defined, precise pulses, square wave, and sawtooth waveforms for pulse, FM, and square wave modulation. It is a valuable accessory for the 0.80-21 GHz Series 1100 Signal Generators and Series 1200 Signal Sources. It can also be used with many other instruments. The repetition rates of all output waveforms are adjustable from 10 to 10,000 Hz. Pulse widths are adjustable from 0.2 to 2000 microseconds. The linear sawtooth output is adjustable in amplitude to vary FM deviation. The 1020A Modulator can be synchronized internally, or externally by positive pulses, negative

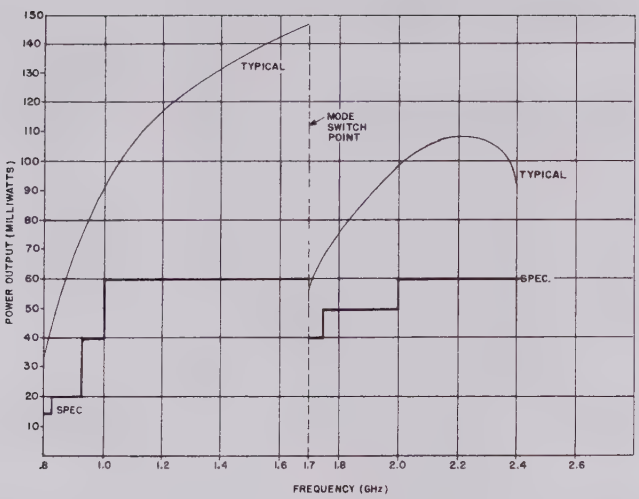


Figure 1-2a. Model 1205E Maximum Power Output Vs. Frequency

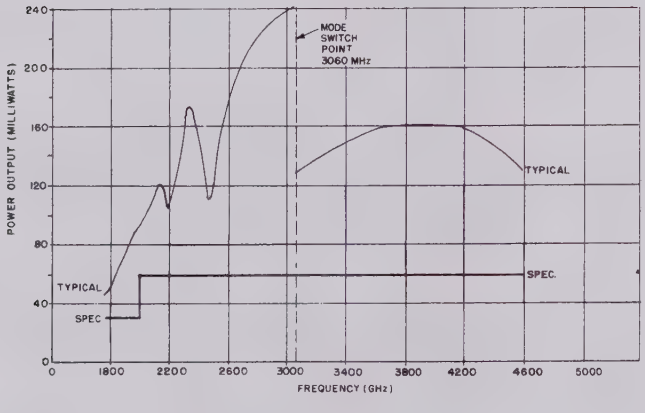


Figure 1-2b. Model 1206E Maximum Power Output Vs. Frequency

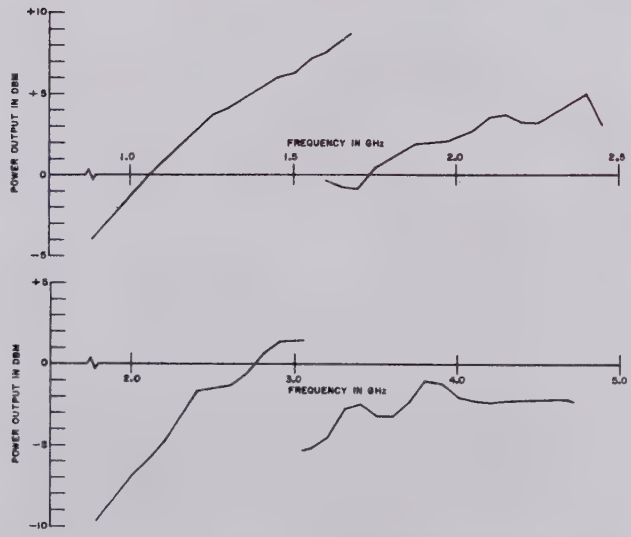


Figure 1-2c. Typical RF MONITOR Output, Models 1105E, 1105E-L and 1205E

Figure 1-2d. Typical RF MONITOR Output, Models 1106E, 1106E-L and 1206E

Figure 1-2. Typical RF Outputs and RF Power Monitor Outputs

TABLE 1-1. EQUIPMENT SUPPLIED

Name	Polarad Model or Part No.	Name	Polarad Model or Part No.
Modular Microwave Signal Generator	1105E (1) 1106E (1) 1105E-L (1) 1106E-L (1)	Power Cable	B160833
		Spanner Wrench	A15550
		Test Connector	A713772
Modular Microwave Signal Source	1205E (1) 1206E (1)	Operating and Maintenance Instructions	–
RF Cable Assembly	B12551		

(1) Either one.

pulses, or sine waves. Sharp 25 volt sync pulse outputs are also generated. Sync outputs are available undelayed and delayed, from two output terminals. The delay is adjustable from 0.3 to 2000 microseconds. The compact Polarad Model 1020A Modulator is provided in a 1-3/4" high modular cabinet which permits convenient rack mounting or stacking with other modular units of this series of Polarad instruments. Four side mounting brackets are supplied for rigid attachment to any companion Polarad instruments. When the top cover is removed, all parts are available for accessibility and ease of servicing. Dimensions: 1-3/4" H x 16-3/4" W x 16-3/8" D.

1-22. An external frequency stabilizer can be used to phase lock the output frequency of Polarad Microwave Signal Generators and Sources, as well as with other instruments. Stabilizers are available from several instrument manufacturer's such as Microwave Systems, Inc. and Frequency Engineering Labs.

1-23. The **Klystron Cap Extender, Part No. B160465,** separates the klystron cap from the oscillator cavity during frequency alignment. Klystron rotational alignment is simplified when the extender is used.

1-24. **Reusable Transit Case P/N 166846:** Fiberglass shell with fitted urethane foam cushioning for protection while shipping or in storage.

Additional technical and ordering information available upon request from:

Polarad Electronics, Inc.
5 Delaware Drive
Lake Success, New York 11042

TABLE 1-2. EQUIPMENT SPECIFICATIONS

Characteristic	Specification
Frequency Range	1105E, 1105E-L, 1205E: 0.80 to 2.40 GHz 1106E, 1106E-L, 1206E: 1.80 to 4.60 GHz
ΔF Control Range	1.5 MHz minimum
Frequency Accuracy (See Note 1)	1105E, 1106E: ±0.5% up to 0 dBm 1105E-L: ±5 MHz or ±0.5% whichever is greater, leveled; ±0.5% unleveled 1106E-L: ±10 MHz leveled; ±0.5% unleveled 1205E: ±0.5% + Frequency Pulling (see figure 1-3) 1206E: ±0.5% (up to ⩽25 mw)
Frequency stability	±0.0003% per volt change in line voltage; ±0.008% per degree C ambient, ±0.005% typical
Output Signals Available	CW (calibrated in 1105E, 1105E-L, 1106E, 1106E-L). Square wave and FM; square wave, FM and pulse modulation with external modulation. External AM provided with 1105E-L and 1106E-L
Calibrated Power Output Range	1105E, 1106E: +6 dBm to −130 dBm 1105E-L, 1106E-L: 0 dBm to −130 dB in leveled operating condition, +6 dBm to −130 dBm in unleveled operating condition 1205E, 1206E: Not applicable
Uncalibrated Power Output	1105E, 1105E-L, 1106E, 1106E-L: ⩾ 10 mw (See Note 2) 1205E: 0.80 to 0.92 GHz, ⩾ 15 mw 0.92 to 1.75 GHz, ⩾ 40 mw 1.75 to 2.40 GHz, ⩾ 50 mw 1206E: 1.80 to 2.00 GHz, ⩾ 35 mw 2.00 to 4.60 GHz, ⩾ 60 mw
Power Monitor Range	1105E, 1105E-L, 1106E, 1106E-L: −3 dBm to +3 dBm 1205E, 1206E: Not applicable
Output Power Absolute Accuracy	1105E, 1106E: ±2 dB (+3 to −127 dBm meter at CAL) 1105E-L, 1106E-L: leveled mode: ±2 dB (0 to −127 dBm, meter at CAL) ± leveling flatness; unleveled mode: ±2 dB (+3 to −127 dBm, meter at CAL)

NOTE 1: For 1105E-L: Frequencies are rated for outputs as great as 0 dBm unleveled and -6 dBm leveled (see paragraph 2-10 for greater stability in leveled mode).
For 1106E-L: Frequencies are rated for outputs as great as 0 dBm.

NOTE 2: At rated frequency of generator.

TABLE 1-2. EQUIPMENT SPECIFICATIONS (Continued)

Characteristic	Specification
Leveled Output Flatness (Models 1105E-L and 1106E-L only)	In Auto-Level Mode, CW, fm, and pulse output: 1105E-L: ±0.75 dB 1106E-L: ±1.0 dB } 0 to −127 dBm
Output Impedance	50 Ohms, nominal
VSWR	1105E, 1106E, 1105E-L, 1106E-L: 2:1 maximum
Connector	Type N
RF Monitor Output	⩾ −10 dBm
Internal Square Wave:	
Rate	1000 ±5% Hz, minimum
ON/OFF Ratio	Infinite (no carrier leakage during OFF time)
Internal FM:	
Rate	Power line frequency
Sweep Width (deviation x 2)	Continuously adjustable to 10 MHz, typical
HOR SWP OUT	2 volts p-p, minimum
HOR SWP PHASE	Adjustable to 90°, minimum
Synchronization	Internal
External Pulse Modulation:	(Polarad Modulator Models 1020A or 1020T recommended)
Pulse Requirements	Positive polarity, 15 to 70 volts peak
Rate	Single pulse to 100 kHz
Width of Output Pulses	0.5 to 2500 microseconds
Rise Time of Output Pulses	0.15 microsecond, maximum
Decay Time of Output Pulses	0.35 microsecond, maximum
ON/OFF Ratio	Infinite (no carrier leakage during OFF time)
External FM Modulation:	
Type and Rate	Any waveshape having fequency components between 10 Hz and 0.5 MHz
Sweep Width (deviation x 2)	0 to 10 MHz, typical
External AM (Models 1105E-L and 1106E-L only)	DC to 1 MHz(0 to 100 kHz up to 80% modulation)
Power Requirements	115 or 230 volts ±10%, 50 to 60 Hz, 90 watts (50 to 400 Hz optional, add suffix "F" to Model Number)
Dimensions	5-1/4 in. (13.3 cm) H x 16-3/4 in. (42.5 cm) W x 19 in. (48.3 cm) D (from front to rear feet)
Weight	51 pounds (23.2 kg)

TABLE 1-3. TRANSISTORS, DIODES, INTEGRATED CIRCUITS, AND KLYSTRON COMPLEMENT

Quantity	Description	Type No.	Quantity	Description	Type No.
2	RECTIFIER, BRIDGE	MDA 970-1	1	TRANSISTOR	2N4402
2	DIODE, ZENER	1N4742A	1	TRANSISTOR	2N4400
9	DIODES	1N456	3	TRANSISTOR	MJE3055T
1	DIODE	EG300	2	TRANSISTOR	2N5988
5	DIODE, ZENER	1N5364B	1	Integrated circuit, voltage regulator	UA78-GU1C
1	DIODE	1N914	1	IC, Schmitt Trigger	CD40014P
2	DIODE, ZENER	1N5281B	1	IC, Dual D-type Flip-Flop	CD4013AE
1	DIODE, ZENER	1N5281B	2	IC, TIMER-OSCILLATOR	SN72555P
1	RECTIFIER, BRIDGE	MDA920A-3	1	IC, fixed voltage regulator	MC78M20CP
8	DIODES, FAST SWITCHING HIGH VOLTAGE RECTIFIER	SH30F	1	IC, precision voltage regulator	SN 72723L
1	DIODE, ZENER	1N4759A	1	IC, Op-Amp.	SN 72741L
1	TRANSISTOR	D40E7	1	KLYSTRONS	A160047* A160036** A160037***
2	TRANSISTOR	2N5415			

*Used in Models 1105E, 1205E and 1105E-L only.
**Used in Models 1106E and 1106E-L only.
***Used in Model 1206E only.

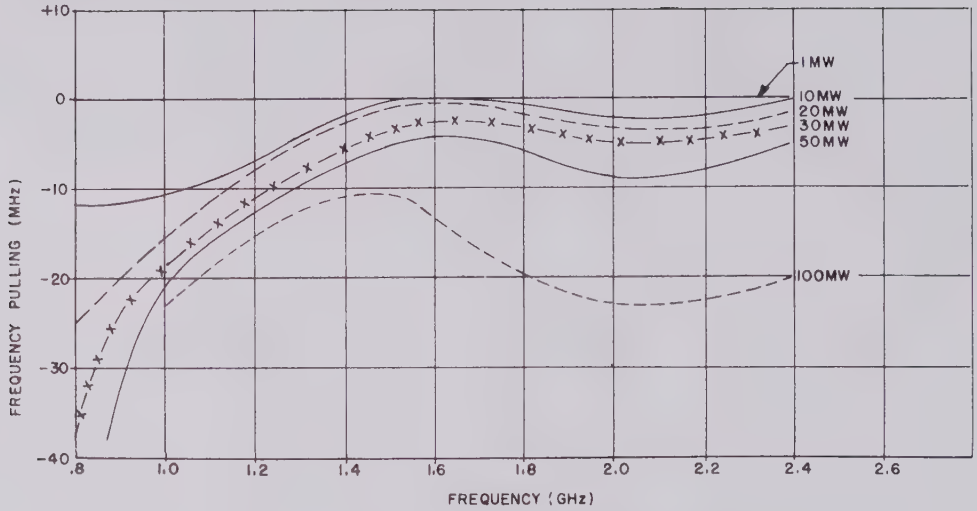


Figure 1-3. Model 1205E Frequency Pulling Characteristic

SECTION II

OPERATION

2-1. GENERAL

2-2. Models 1105E/1105E-L, 1106E/1106E-L, 1205E, and 1206E are shipped complete and ready to operate; no special or permanent installation procedures are required. The instruments should be unpacked upon receipt, observing the usual precautions customary when unpacking an electronic instrument.

2-3. INSTALLATION

2-4. After unpacking the instrument, plan its installation. If it will be used on a bench or cart, the required space is shown in figure 2-1. If it will be mounted in a rack, the handles at either end of the panel should be reversed as shown in figure 2-1 for rack mounting. The instrument requires 115 or 230 volts, single phase, 50-60 Hz ac power.

Note

Models 1105E/1105E-L, 1106E/1106E-L, 1205E and 1206E are shipped ready for 115-volt operation. If the instrument will be operated from a 230-volt source, set the 115/230 volt switch in the rear to the 230-volt position and change fuse to 0.75 amp. The location of the switch is shown in figure 2-2.

2-5. Connect power line cord B160833 to ac input of the instrument and then into an ac power source.

2-6. OPERATING PROCEDURES

2-7. The operating procedures for Models 1105E, 1105E-L, 1106E, 1106E-L, 1205E, and 1206E are described in paragraphs 2-8 through 2-18.

2-8. OPERATING CONTROLS, INDICATORS, AND CONNECTORS. The operating controls, indicators, and connectors of the instrument are shown in figure 2-2, and their functions are listed in table 2-1.

2-9. CONNECTION AND PRELIMINARY OPERATION. To operate Models 1105E, 1105E-L, 1106E, 1106E-1106E-L, 1205E, and 1206E, proceed as follows:

a. Connect instrument to device under test and external modulation source, if required, as shown in figure 2-3.

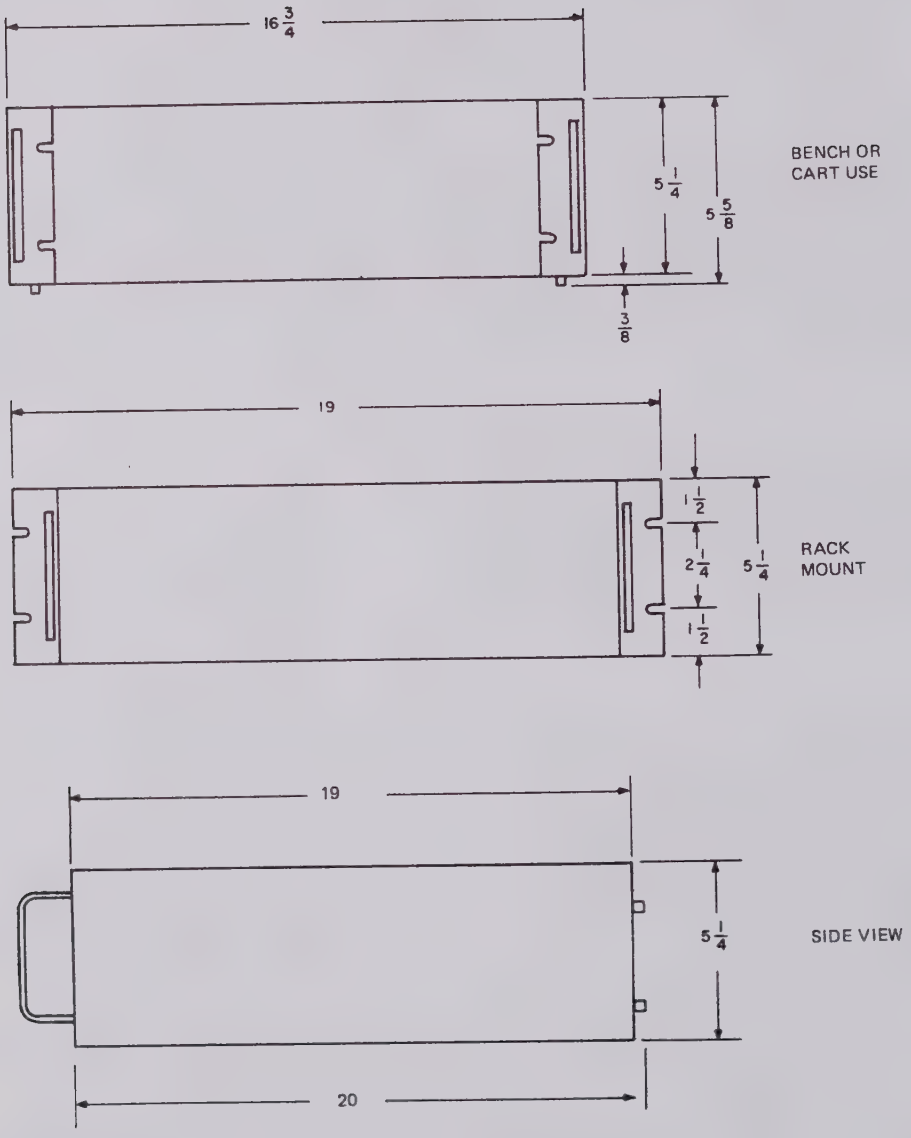
CAUTION

During the initial operation of the unit, the ΔF control should be set at "0." It is used for fine frequency adjustment up to 1.5 MHz. Caution should be exercised, however, when offsetting the ΔF control. At some frequencies, its range is so great that the oscillator mode may be shifted by excessive ΔF rotation. This effect may result in large frequency shifts that may appear to be a loss of signal or jump in frequency in equipment under test. For normal operation, return the ΔF control to "0" and limit the ΔF rotation as required. The lower frequency range of Models 1105E, 1105E-L and 1205E between 0.8 to 1.00 GHz and Models 1106E, 1106E-L, and 1206E between 1.8 and 2.0 GHz are particularly sensitive to excessive ΔF rotation.

b. Set POWER switch to ON and allow the instrument to warm up for 20 minutes.

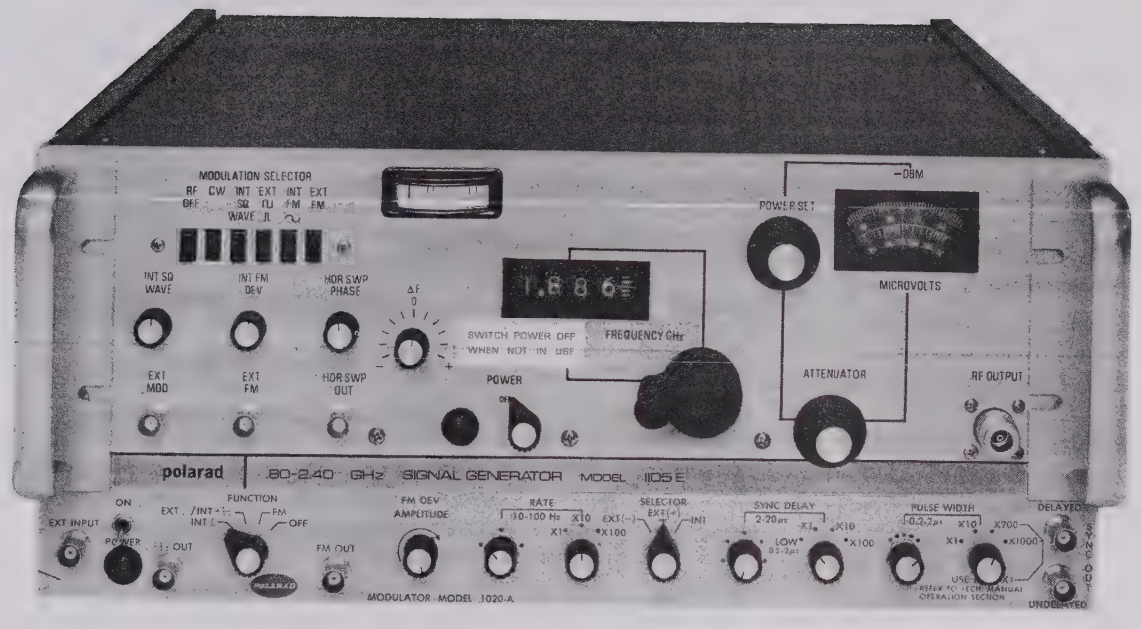
c. Tune the frequency control for a readout of the desired frequency on the FREQUENCY GHz dial.

d. On Models 1105E and 1106E only, set the MODULATION SELECTOR switch to CW position and adjust the POWER SET control for a power monitor meter indication of CAL.

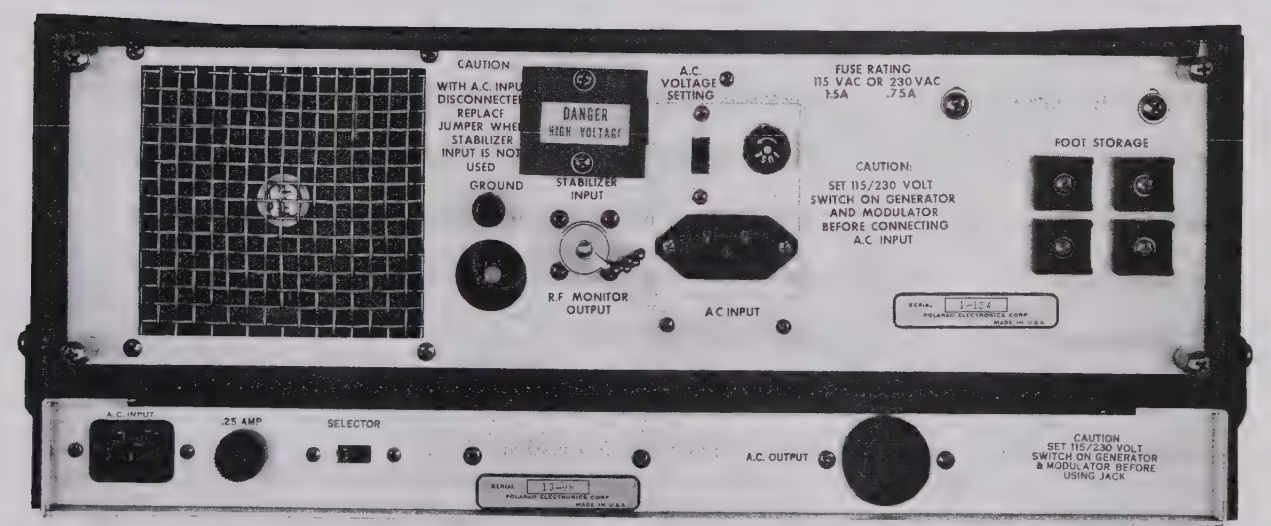


NOTE: ALL DIMENSIONS ARE IN INCHES

Figure 2-1. Models 1105E, 1106E, 1205E, 1206E, 1105E-L, and 1106E-L, Outline Installation Drawings



FRONT



REAR

Figure 2-2. Operating Controls, Indicators, and Connectors

TABLE 2-1. OPERATING CONTROLS, INDICATORS, AND CONNECTORS

Controls, Indicators, and Connectors	Function
POWER switch	Controls application of ac power
Power indicator lamp	Lights when power is applied to instrument
MODULATION SELECTOR pushbutton switch	Selects type of modulation as follows: RF OFF . . . . . Disables rf output; standby position CW . . . . . No modulation present INT SQ WAVE . . . . . Internal square wave modulation EXT ⊓⊓ . . . . . External square wave or pulse modulation INT FM ~ . . . . . Internal FM line frequency modulation EXT FM . . . . . External FM modulation
AUTO-LEVEL ON switch***	Used to turn automatic leveling on and off
AUTO-LEVEL CAL control***	Used to calibrate automatic leveling
EXT A.M. connector***	Accepts input for external modulating signals
POWER SET/AUTO-LEVEL SET***	Used to calibrate attenuator or automatic leveling circuit on Models 1105E-L and 1106E-L
INT SQ WAVE control	Adjusts square wave frequency over the range of 950 to 1050 Hz minimum
INT FM DEV control	Adjusts amplitude of internal fm driving signal
HOR SWP PHASE control	Controls phase of horizontal sweep signal to oscilloscope
EXT MOD connector	Accepts external pulse or square wave modulation signal
EXT FM connector	Accepts external fm signal
HOR SWP OUT connector	Output for horizontal sweep signal to oscilloscope
FREQUENCY GHz dial	Displays digital frequency readout
Frequency control	Adjusts instrument frequency
ΔF control	Fine frequency control. May be used to maximize system power output, control pulse jitter, and center FM sweep
ATTENUATOR control	Adjusts power level of instrument

TABLE 2-1. OPERATING CONTROLS, INDICATORS, AND CONNECTORS (Continued)

Controls, Indicators, and Connectors	Function
RF OUTPUT connector	Available RF power output
POWER SET control**	Used to adjust oscillator power level for power monitor meter indication of CAL
Attenuator dial**	Displays readout in dBm and microvolts of attenuator output at the RF OUTPUT connector when power meter is set to CAL
Power monitor meter**	Used to set power level of instrument for attenuator calibration
RF MONITOR OUTPUT connector*	Used for automatic frequency stabilization or auxiliary RF OUTPUT
STABILIZER INPUT terminals*	Used for automatic frequency stabilization
AC INPUT connector*	Power cord input
115/230V selector switch*	Selected according to ac voltage of power source
FUSE*	Protects instrument from damage

*Located on rear panel.
**Model 1105E and 1106E only.
***Models 1105E-L and 1106E-L only.

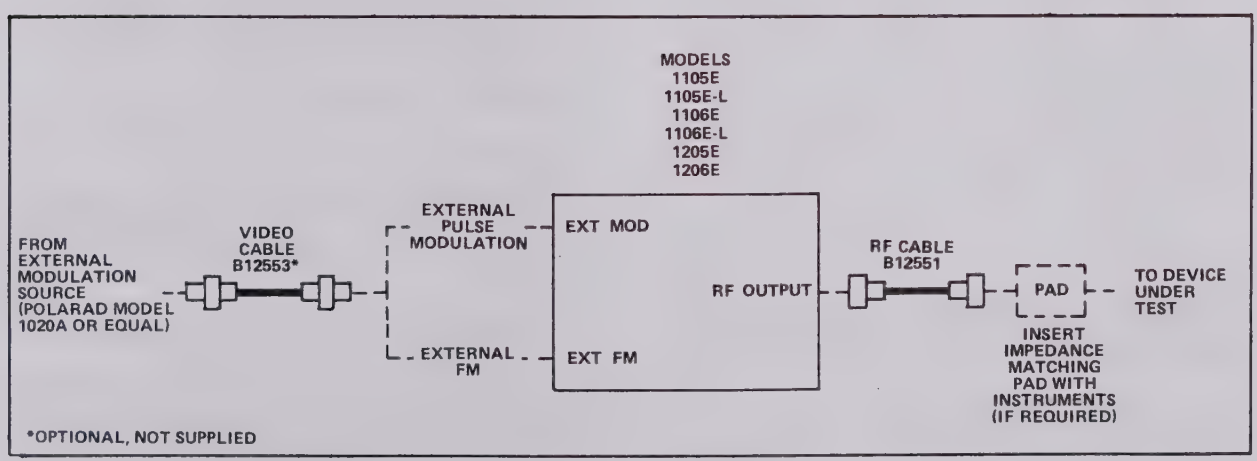


Figure 2-3. Models 1105E, 1105E-L, 1106E, 1106E-L, 1205E, and 1206E Connections For Use

Note

The power monitor meter is graduated from −3 to +3, with the CAL marking midway between the extremes. If the POWER SET control is adjusted to obtain an indication other than CAL, the indication of the power monitor meter should be algebraically added to the reading of the attenuator dial. For example, if the power monitor meter reads −2 and the attenuator dial is set at −56 dBm, the power level at the RF OUTPUT connector would be −58 dBm.

e. On Models 1105E and 1106E only, adjust the ATTENUATOR control for the desired power output level at the RF OUTPUT connector. If required, correct the reading of the attenuator dial for power monitor meter readings other than CAL, as described in the preceding note.

Note

Use of the 6 dB range of the power monitor meter provides an additional 3 dB at each end of power output range, giving an overall range from +6 dBm to −130 dBm.

f. On Models 1105E-L and 1106E-L only, set MODULATION SELECTOR switch to CW, AUTO LEVEL ON switch to ON, POWER SET/AUTO-LEVEL SET control so that the red line on the control lines up with the red line on the panel and adjust the AUTO-LEVEL CAL control for a power monitor meter indication of CAL. The AUTO-Level is set at 800 MHz for the Model 1105E-L (1800 MHz for the Model 1106E-L). The control should not be set at other frequencies. To operate without automatic leveling, set AUTO-LEVEL switch to OFF and operate as for a 1105E or 1106E.

g. On Models 1205E and 1206E, set the MODULATION SELECTOR switch to CW and adjust the ATTENUATOR control for the desired power output level at the RF OUTPUT connector. There is no attenuator dial on these models.

h. To operate Models 1105E and 1106E at another frequency, perform steps c, d, and e.

i. To operate Models 1105E-L and 1106E-L at another frequency, perform steps c and f.

j. To operate Models 1205E and 1206E at another frequency, perform steps c and g.

Note

The ΔF control provides a frequency vernier with a minimum range of 1.5 MHz. Always reset to "0" when not used.

k. To place the set on stand-by, set the MODULATION SELECTOR switch to RF OFF.

2-10. CW OPERATION (1105E, 1105E-L, 1106E, 1106E-1106E-L, 1205E, 1206E). For CW operation proceed as follows:

a. Set the FREQUENCY GHz control to the desired frequency.

b. Depress the CW button on the MODULATION SELECTOR switch. In this mode, the INT SQ WAVE and INT FM DEV controls have no effect.

CAUTION

It is possible to make Signal Generators/Sources inoperative by driving the attenuator probe too far into the oscillator cavity of the Signal Generator/Source. If this occurs, back off the attenuator by turning the ATTENUATOR control counterclockwise for Models 1105E, 1105E-L, 1106E and 1106E-L and clockwise for Models 1205E and 1206E. Set the MODULATION SELECTOR switch to RF OFF and repeat steps a and b of paragraph 2-10.

c. Set the ΔF control to "0."

d. Adjust the POWER SET control for a reading of CAL on the power meter (1105E and 1106E only). See step f paragraph 2-9 for 1105E-L and 1106E-L.

e. Connect RF OUTPUT to unit under test.

f. Adjust the ATTENUATOR control for the desired output on the attenuator dial. There is no attenuator dial on Models 1205E and 1206E.

g. **Higher order frequency stability in leveled mode.** In the normal leveled operating mode, the power output level is stabilized as the unit is tuned through its full frequency range. For most applications, however, a more limited frequency test range is required. In the latter case, if

leveling is set within the limited frequency range of interest, less frequency change will be experienced. Use the following operational procedure.

(1) Tune the signal generator to 0.800 GHz (1105E) and 1.800 GHz (1106E).

(2) Adjust the AUTO-LEVEL CAL control fully cw.

(3) Adjust the POWER SET control until the meter reads 1/2 dB above CAL.

(4) Adjust the AUTO-LEVEL CAL control for a meter reading of CAL.

(5) The leveled operation within the frequency band of interest is now set and the flatness and output power test may be performed.

2-11. INTERNAL SQUARE WAVE MODULATION OPERATION (1105E, 1105E-L, 1205E, 1106E, 1206E AND 1106E-L). For internal square wave modulation, perform steps a through f of paragraph 2-10. Depress the INT SQ WAVE button on the MODULATION SELECTOR switch and adjust the INT SQ WAVE control for the desired square wave frequency.

2-12. INTERNAL FM OPERATION (1105E, 1105E-L, 1106E, 1106E-L, 1205E, 1206E). For internal fm operation, perform steps a through f of paragraph 2-10.

a. Depress the INT FM ~ button on the MODULATION SELECTOR switch.

b. Adjust the INT FM DEV control to obtain the desired sweep width.

Note

To obtain maximum FM deviation, it may be necessary to vary the ΔF control.

c. To observe the frequency response of a component or system, under test, proceed as follows:

(1) Feed the RF OUTPUT signal through a frequency meter to the item under test.

(2) Feed the detected output to the vertical input of an oscilloscope.

(3) Connect the HOR SWP OUT to the horizontal input of the oscilloscope.

(4) Set the oscilloscope vertical and horizontal gains for full scale deflection.

(5) Adjust the INT FM DEV control so that the FM deviation is sufficient to observe the frequency response.

(6) Adjust the HOR SWP PHASE control so that the forward and reverse sweeps are overlapped.

(7) Adjust the frequency to measure the frequency response by observing the frequency of the pip from one end of the response to the other.

2-13. EXTERNAL FM OPERATION (MODELS 1105E, 1105E-L, 1106E, 1106E-L, 1205E, 1206E). For external fm operation, perform steps a through f of paragraph 2-10 and proceed as follows:

a. Connect the modulation source to the EXT FM connector.

Note

Polarad Models 1020A and 1020T Modulators are recommended for external pulse, FM, and square wave modulation.

b. Depress the EXT FM button on the MODULATION SELECTOR switch.

c. Adjust the external modulation source for the desired FM characteristics.

2-14. EXTERNAL PULSE/SQUARE WAVE OPERATION. For external pulse/square wave operation, perform steps a through f of paragraph 2-10 and proceed as follows:

a. Connect the modulation source to the EXT MOD connector.

b. Depress the EXT ⊓ ⊓ button of the MODULATION SELECTOR switch.

c. Adjust the external modulation source for the desired pulse modulation characteristics.

TABLE 2-2. MODULAR MICROWAVE INSTRUMENT COMBINATIONS

Instrument	Modulator	Capabilities
1105E, 1105E-L and 1205E	1020A	0.80 to 2.40 GHz frequency range with full modulation capabilities.
1106E, 1106E-L and 1206E	1020A	1.80 to 4.60 GHz frequency range with full modulation capabilities

Note

At some frequency settings, it is advisable for most stable pulse modulation to adjust the ΔF control. A detector and an external oscilloscope can be used to display the detected output pulse.

2-15. EXT AM MODULATION OPERATION (For Models 1105E-L and 1106E-L only). Set the instrument for automatic leveling operation as directed in paragraph 2-9 step f. Connect the external amplitude modulation source to the EXT AM connector on the rear panel of the instrument. Set the instrument for leveled cw at the desired frequency and power output. Detect the rf output signal and monitor the detected signal on an oscilloscope. Adjust the level of the external modulation signal to achieve the desired percentage of modulation.

Note

The available percentage of upward modulation at a given power level is a function of Klystron power output. Klystron power output varies with frequency. If the desired percentage of modulation cannot be obtained without clipping of the upward peaks observed on the oscilloscope, reduce the average power output of the instrument by turning the AUTO-LEVEL CAL control counterclockwise until the clipping disappears.

2-16. EXTERNAL SQUARE WAVE SYNCHRONIZATION.* When the instrument is being operated in the internal modulation square wave mode, an external source of synchronization can be used for the square wave modulation signal generated within the instrument. This external source is connected to the EXT SQ WAVE SYNC connector at the rear of the instrument.

*Models 1105E-L and 1106E-L with option "V" only.

2-17. AUTOMATIC FREQUENCY STABILIZATION. Models 1105E, 1105E-L, 1106E, 1106E-L, 1205E, and 1206E include provisions for atuomatic frequency stabilization to better than 10 Hz, with the degree of stabilization being dependent on the gain and stability of the external control system used. The input of the phase- or frequency-control system used is connected to RF MONITOR connector at the rear of the instrument and the output of the control system is connected to the STABILIZER INPUT terminals, also at the rear of the instrument.

2-18. OPERATION WITH OTHER MODULAR MICROWAVE INSTRUMENTS. In addition to the individual use of the Signal Generators and Sources, they can be grouped with other instruments in the Modular Microwave series to extend their capabilities. Table 2-2 lists some of the possible combinations and their capabilities.

2-19. PACKAGING INSTRUCTIONS

2-20. PACKAGING FOR SHORT TERM STORAGE. If the instrument is to be stored for a relatively short period, cover it with a suitable protective covering, such as a sheet of plastic or paper. Put the accessories and instruction manual in an envelope or bag and fasten it to the instrument to prevent loss. Store the instrument in a clean and dry area where it will not be subjected to extreme temperatures.

2-21. PACKAGING FOR LONG TERM STORAGE OR SHIPMENT. (See figure 2-4.) If the instrument is to be stored for a long time or shipped, proceed as follows:

a. Save the original wrappings and carton and repackage the instrument in them. The original packing material properly cushions the instrument for shipment.

b. If the original packing has not been saved, call Polarad Electronics, Inc. for proper shipping instructions.

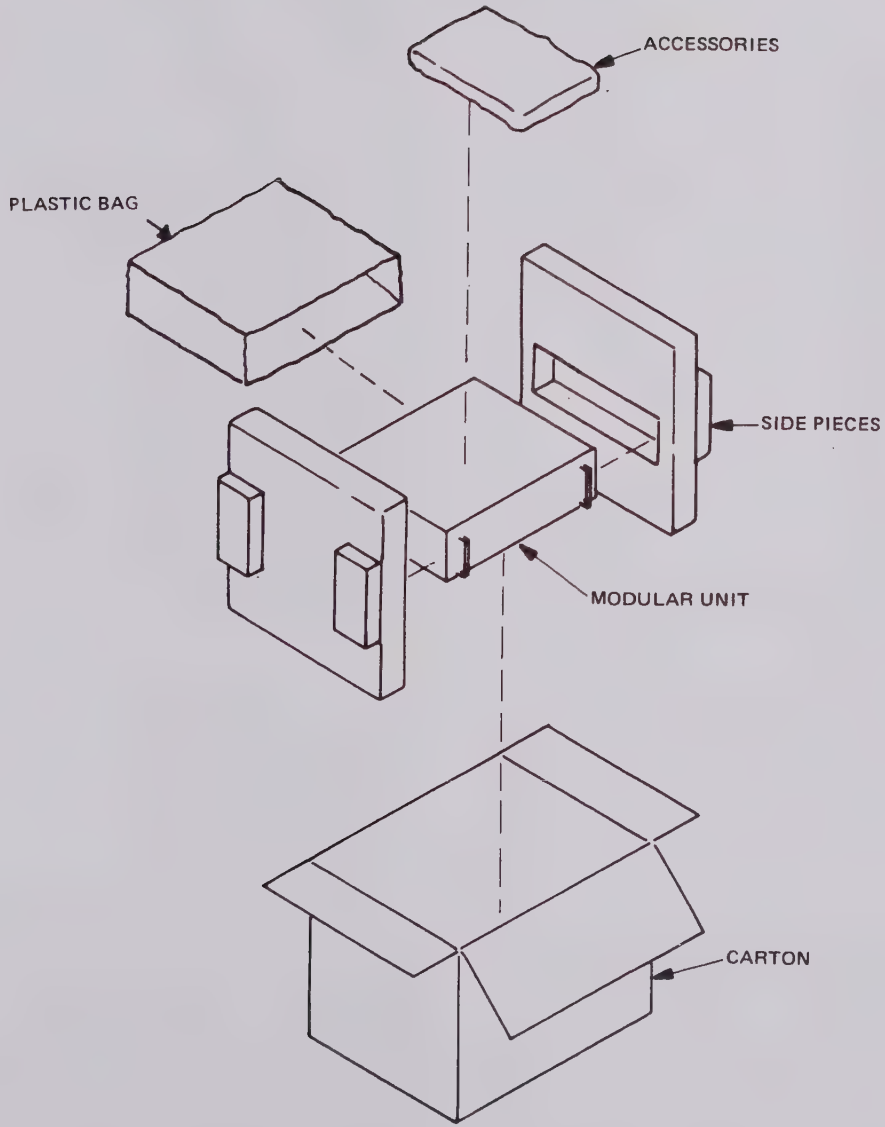


Figure 2-4. Packaging Diagram

SECTION III

THEORY OF OPERATION

3-1. GENERAL

3-2. Modular Microwave Signal Generators, Models 1105E, 1106E, 1105E-L, and 1106E-L and Modular Microwave Signal Sources, Models 1205E and 1206E are signal-generating devices that employ klystron oscillators with external cavities to generate rf energy. The Signal Generators have calibrated attenuators and 50-ohm output impedances; the Signal Sources have uncalibrated attenuators and a reactive output impedance. The Signal Generators have maximum available calibrated output power of +6 dBm; the Signal Sources both have maximum available power output of at least 30 milliwatts as a function of frequency. The Models 1105E-L and 1106E-L Signal Generators incorporate leveling features that maintain a constant output over the full instrument output frequency range. The frequency ranges of these instruments, and the other Signal Generators and Signal Sources, are listed below:

Model	Range, GHz
1105E	0.80 to 2.40
1105E-L	0.80 to 2.40
1106E	1.80 to 4.60
1106E-L	1.80 to 4.60
1205E	0.80 to 2.40
1206E	1.80 to 4.60

3-3. BLOCK DIAGRAM ANALYSIS

3-4. MODELS 1105E-L AND 1106E-L. Modular Microwave Signal Generators, Models 1105E-L and 1106E-L are identical except for their individual frequency ranges. Figure 3-1 contains a block diagram that is applicable to either model. Each model consists of 10 principal circuit elements: a klystron oscillator, its repeller tracking system, a beam power supply, a repeller power supply, a 40V power supply for modulation circuits, a Schmitt trigger, a square wave generator, two attenuators, a level detector and a leveling circuit with leveling power supply. The klystron oscillator employs a reflex klystron tube in an external coaxial cavity, which is tuned to resonance by a non-contacting tuning plunger driven by the frequency control. The frequency drive system also operates the digital read-out frequency dial and the tracking system, which selects the proper repeller mode and adjusts the repeller voltage for the frequency selected. The power supplies are completely solid-state using monolithic linear integrated circuits as precision voltage regulators. The Schmitt trigger followed by the amplifier delivers the square wave and pulses to the klystron oscillator. The square wave generator is a D-type Flip-Flop (A3A1U4) whose variable frequency is controlled by the timer A3A1U3 from 950 to 1050 Hz, minimum.

3-5. The generators incorporate a power monitor circuit that permits the attenuator to be calibrated in dBm and microvolts. Adjusting a POWER SET/AUTO-LEVEL SET control moves the power monitor probe and attenuator dial hairline. The power monitor probe couples rf power from the klystron cavity to attenuator AT2. Attenuator AT2 attenuates the rf signal and feeds it to a level detector to produce a detected input to a leveling circuit. The leveling circuit amplifies the detected rf and applies it to a power monitor meter. The leveling circuit output can be used for power monitoring or automatic leveling operation. In power monitoring operation, the POWER SET/AUTO-LEVEL SET control is adjusted for a power monitor meter indication of CAL when power monitor probe is coupled to a 1-mw power level.

3-6. The attenuator control operates the attenuator probe and dBm-microvolts dial to provide a calibrated rf output. In automatic leveling operation, the POWER SET/AUTO-LEVEL SET control is lined up with a preselected position and bias outputs of the leveling circuit are fed to attenuators AT1 and AT2. The amplitude of the bias signals determines the attenuation that is produced in both attenuators AT1 and AT2. If the rf output of the power meter probe tends to change as the klystron frequency changes, the amplitude of the bias signals also changes with a magnitude and polarity that adjusts the attenuation factors of the attenuators. The adjustment compensates for the rf amplitude variation. The power level at the RF OUTPUT connector is thereby maintained constant.

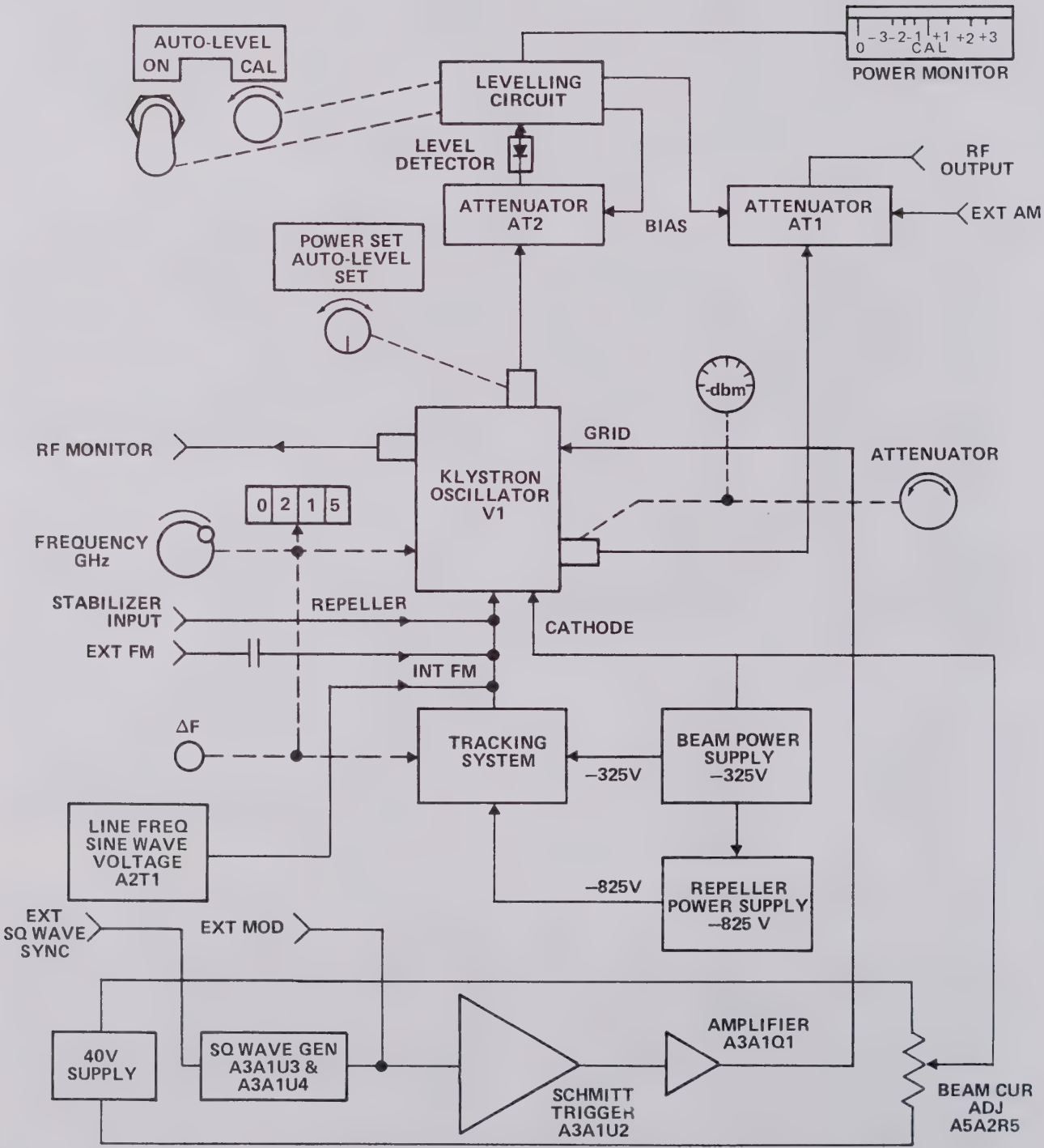


Figure 3-1. Modular Microwave Signal Generators, Models 1105E-L/1106E-L Block Diagram

3-7. In addition to the leveling feature, the Models 1105E-L and 1106E-L incorporate a provision for automatic frequency stabilization. A sample of power in the klystron oscillator is fed to an external control system and the output of the external control system is fed to the klystron repeller as a correction voltage which is superimposed on the repeller voltage.

3-8. MODELS 1105E AND 1106E. The theories of operation of the Modular Microwave Signal Generators, Models 1105E and 1106E, are essentially identical to each other and are similar to the Models 1105E-L and 1106E-L described in paragraphs 3-4 through 3-7. The Models 1105E and 1106E include a power monitoring circuit, but not a leveling circuit. The power monitoring circuit enables the attenuator to be calibrated directly in dBm and microvolts. The power set drive system moves the power probe and the hairline of the attenuator dial. The power monitor probe couples rf power from the klystron cavity to the crystal detector and power monitor meter. When the POWER SET control is adjusted for a power monitor indication of CAL, the power monitor probe is coupled to approximately 1 milliwatt power level. The ATTENUATOR control operates the attenuator probe and the dBm-microvolts dial to provide a calibrated rf output.

3-9. MODELS 1205E AND 1206E. Modular Microwave Signal Sources, Models 1205E and 1206E, are essentially identical to each other, differing in their frequency ranges. These Signal Sources are similar to the Models 1105E-L and 1106E-L Modular Microwave Signal Generators, differing in the fact that they do not include the power monitoring and power leveling features described in paragraphs 3-4 through 3-7.

3-10. DETAILED THEORY OF OPERATION (See figures 5-1 through 5-7.)

3-11. KLYSTRON OSCILLATOR. A klystron oscillator, V1 provides the rf power output. It is velocity-modulated, operating in an external resonant coaxial transmission line and consists of two conductors, one inside the other. The klystron is mounted at one end of the cavity with the outer cylinder making cntact with the first grid and the inner conductor making contact with the second resonator grid. The resonant circuit is completed at the other end of the cavity by a moveable non-conducting shorting plunger. The position of this plunger determines the resonant frequency of the cavity.

3-12. The frequency of oscillation of the klystron oscillator is determined by the resonant frequency of the cavity and the magnitude of the repeller voltage. For a given setting of the cavity, there is an optimum repeller voltage that will cause the bunched electrons to return to the resonator grids at the proper time. The repeller voltage, therefore, cannot remain the same over the frequency range of the oscillator. In order to produce oscillation over the frequency range of the oscillator, a tracking arrangement is used to vary the dc voltage on the repeller so that it is maintained at the optimum value for a given plunger setting. The required voltage ranges as a function of frequency, are shown in figures 4-6 and 4-7.

3-13. The oscillator cavity output is coupled through three probes; the attenuator probe with a variable amount of insertion that determines the rf power level delivered to the rf output connector, the fixed rf monitor probe that supplies the power sample for automatic frequency stabilization, and the power monitor probe with a variable amount of insertion that supplies power to the monitoring circuit for attenuator calibration and leveling.

3-14. MODE SWITCHING. The frequency of oscillation of the klystron oscillator is determined by the resonant frequency of the cavity and the magnitude of the repeller voltage. For a given setting of the cavity, there is an optimum repeller voltage that will cause the bunched electrons to return to the resonator grids at the proper time. The repeller voltage, therefore, cannot remain the same over the frequency range of the oscillator. In order to produce oscillation over the frequency range of the oscillator, a tracking arrangement is used to vary the dc voltage on the repeller so that it is maintained at the optimum value for the maximum amplitude of oscillation. At a certain frequency value (1.7 GHz for Models 1105E, 1105E-L, and 1205E, 3.06 GHz for Models 1106E, 1106E-L, and 1206E), the repeller voltage becomes excessively high and it is more practical to change the repeller voltage to a new range. This can be done without changing the frequency of oscillation at a given cavity setting by lowering the repeller voltage so that the tube operates in a higher mode. In the higher mode, the bunched electrons require a longer time in cycles to be returned to the resonator grids. All of the models described operate in the 1-3/4 and 2-3/4 modes. The switching arrangement is described in paragraph 3-15.

3-15. REPELLER VOLTAGE TRACKING SYSTEM. The dc voltage applied to the repeller is controlled by tracking potentiometer A7R1. The movement of the arm of A7R1 is mechanically ganged with the movement of the

tuning plunger in the klystron cavity so that the repeller voltage is maintained at the optimum value for the maximum amplitude of oscillation. Repeller modes switch A7S1 is operated by a cam driven by the tuning drive and changes the voltage applied to A7R1 so that a different mode can be used. The values of the resistors in the tracking circuit are calculated for the proper frequency-vs-voltage characteristic. Adjustment potentiometers are provided in the tracking circuit to compensate for variation in klystron repeller voltage characteristics. The maximum voltage across tracking potentiometer A7R1 is 500 v. since it is connected from the -315 volt beam supply to the -825 volt repeller supply. The cathode of klystron V1 is connected to the -325 volt beam supply and therefore the repeller voltage can vary from 0 to -500 volts.

Note

The ΔF control A3A2R28 provides a small variation in the repeller voltage, which produces a vernier frequency variation of at least 1.5 MHz.

3-16. PROTECTIVE DIODE. Protective diode A3A1CR4 is connected between the cathode and repeller of klystron V1 to prevent the repeller from becoming more positive than the cathode which would damage the klystron.

3-17. FREQUENCY CONTROL KNOB. The frequency control knob rotates the shaft which drives the digital readout, the cam that positions the tuning plunger, and the tracking potentiometer, each through the appropriate gearing. The shaft extends through the tuning mechanism casting to the rear of the instrument where it can be attached to an external motor drive, if required.

3-18. CALIBRATED ATTENUATION OPERATION. Power from the klystron cavity is coupled through two symmetrical pipes into two matched waveguide-beyond-cutoff attenuators. The POWER SET (Models 1105E, 1106E, 1105E-L, and 1106E-L only) control positions the power set probe in its pipe. The power set probe couples rf power from the klystron cavity to the crystal detector and the power monitor meter and also moves the hairline of the attenuator dial. When the POWER SET control is adjusted for a power monitor meter indication of CAL, the power set probe is coupled to approximately 1 milliwatt power level. Should the energy level within the cavity change when the cavity is tuned to a different frequency, the power set probe must be reset to obtain the 1 milliwatt level of power absorption which will bring the power monitor meter back to its reference CAL position. At the same time, the hairline is repositioned to a new 0 dBm reference.

3-19. When the POWER SET adjustment is set for CAL, the attenuator probe is adjusted for 0 dBm output at the same time that the attenuator dial is adjusted for 0 dBm under the hairline. In this way, as frequency is varied, and the power monitor meter is set for CAL by placing the attenuator dial at 0 dBm under the hairline, the output will be 0 dBm within the specification accuracy. During leveling circuit operation of 1105E-L and 1106E-L, the POWER SET control is maintained in one set position.

3-20. In order to obtain other levels of power, the ATTENUATOR control is adjusted so that the desired level is under the hairline of the attenuator dial. This adjustment varies the position of the attenuator probe in its waveguide-beyond-cutoff pipe. The rate of attenuation within the pipe follows a rigid physical law and is extremely accurate, thus the rate of attenuation is transcribed into the dial.

3-21. MODELS 1105E-L AND 1106E-L LEVELING CIRCUIT OPERATION. The tracking voltages of +8.2v and -8.2v (see figure 5-2) for the leveling circuit are generated by the bridge rectifier A11BR1, suitable filtering capacitors A11C1 through A11C4 and fixed +8.2 volts voltage regulator A11U1. The negative voltage -8.2 volts is tracked to the referenced +8.2 volts by the error detector and amplifier A11U2A and the transistor follower A11Q1.

3-22. The AUTO-LEVEL indicator light A11CR3 derives its power from the -8.2v supply. Transistor A11Q3 (2N4400) holds the voltage low in the OFF position of the AUTO-LEVEL switch and switches it to high in the "ON" position.

3-23. The signal input for the level control amplifier is derived from the klystron power set probe feeding attenuator AT2. (See figure 5-7.) Attenuator AT2 is a PIN attenuator that has an attenuation factor that is determined by the amplitude of a bias signal received from the level control amplifier. The bias signal is developed by detecting the rf output of attenuator AT2 with the level detector and then amplifying it. Attenuator AT2, the level detector, and the level control amplifier are therefore connected in a feedback loop.

3-24. Detected attenuator AT2 output is applied by the level detector to broadband amplifier A11U3 in the level control amplifier. (See figure 5-7.) Amplifier A11U3

amplifies the input signal, which is then coupled by emitter follower A11Q2 to peak detector network A11CR1-A11R10-A11C9. The peak detector network develops a d-c level the amplitude of which is proportional to the peak level of pulses received during pulse modulation operation or the peak of the CW level during CW operation.

3-25. The peak detector output is amplified by high input impedance amplifier A11U4 which isolates the peak detector network. The amplifier A11U4 output is fed through resistor A11R1 to the power level meter. The meter deflects by an amount that is proportional to the output of the attenuator.

3-26. The amplifier A11U4 output is also fed to one input of differential amplifier A11U2B. The other input is a reference level established by the positioning of the external AUTO-LEVEL potentiometer A11R14 shown in figure 5-7. Amplitude differences from this reference level are amplified and applied to the AUTO LEVEL terminal of the AUTO-LEVEL switch. With the switch in the AUTO-LEVEL ON position, the amplifier A11U2B output is fed to the wiper of the attenuator balance adjust potentiometer (figure 5-7) to develop bias inputs to PIN attenuators AT1 and AT2. (See figure 5-2.)

3-27. If the output of attenuator AT2 tends to vary in amplitude, the action of the level detector and the level control amplifier causes the bias signal fed to attenuator AT2 to change in amplitude and polarity to compensate for the amplitude change. The attenuator AT2 output therefore returns to its original level as established by the positioning of the AUTO-LEVEL potentiometer A11R14.

3-28. The bias signal applied to attenuator AT1 changes by the same amount as the bias signal applied to attenuator AT2, since both bias levels are developed across the same potentiometer. The attenuation factor of attenuator AT1 thus tracks the attenuation factor of AT2, having the same quantitative value and changing by the same amount, when applicable. Since attenuator AT1 is connected between the attenuator probe of the klystron and the RF OUTPUT connector at the front of the instrument, that attenuator controls the amplitude of the rf output of the instrument. Tracking attenuator AT2 as attenuator AT1 does maintains the rf output at a constant level.

3-29. The slope of the curve between bias voltage and the attenuation of the pin attenuator depends upon the initial bias voltage. Since at the mode switch points (1.7 GHz for 1105E-L and 3.06 for 1106E-L), the rf levels are different before and after the switch point, the two slopes are brought in unison by the Mode Overlap Adj. control A11R23.

3-30. The attenuation characteristics of the pin attenuators AT1 and AT2 are made identical by adjusting the Flatness Adj. Control A11R22.

3-31A. The Zero Set potentiometer A11R9 is used to adjust the zero of power monitor meter in RF OFF position.

3-31B. Level-Unlevel Balance control A11R12 is used to set CAL in power monitor meter in unlevelled operation.

3-32. SCHMITT TRIGGER AND AMPLIFIER. The Schmitt trigger A3A1U2 is a gate with fast rise and decay times. The positive voltage to A3A1U2 is held at +12 volts and the negative supply at ground using dropping resistor A3A1R13 and zener diode A3A1CR1. The ground is references at -355 V. Diodes A3A1CR2 and A3A1CR3 act as protective diodes for A3A1U2 and A3A1C15 is a speed up capacitor to handle fast pulses. The input to the gate (pin 1) is held at +12V in the CW, INT FM and EXT FM positions and at ground (-355 volts) in the RF OFF, INT SQ WAVE and EXT ⊓ ⊓ positions via the MODULATION SELECTOR switch (see paragraph 3-35 for more details). The output of the gate (pin 2) is amplified by transistor A3A1Q1 to a suitable level so that the grid of the klystron is biased properly for different modes of operation. In the amplifier circuit A3A1CR5 is a protective diode for A3A1Q1, and A3A1C14 is a speed up capacitor. The amplifier itself acts as an inverter, and the gate A3A1U2 also acts as an inverter; therefore, the logic output of A3A1Q1 is the same as the intput of the gate A3A1U2.

3-33. TIME DELAY CIRCUIT. There is a time delay of approximately 60 seconds when the set is turned on before the beam, repeller and control supply voltages are turned on. This delay is necessary in order that the klystron tube not be damaged. The time delay is accomplished by utilizing integrated circuit A4U1. Pin 3 of A4U1 is held high (approximately 12 volts) for a period determined by the RC time constant of A4R13 and A4C7. When A4C7 charges to a high enough level, the timer A4U1 changes its state at pin 3 from 12 volts to ground, which in turn, changes the output of voltage regulator A4U3 so that the oscillations start and all the supplies (-335, -825, and 40 V) turn on (see paragraph 3-44 for more details). Zener diode A4CR4 and resistor A4R14 are used to supply a bias voltage of 12 volts to integrated circuit A4U1.

3-34. SQUARE WAVE GENERATOR. Square waves, variable from 950-1050 Hz, are generated using A3A1U3 and A3A1U4. A3A1U4 is utilized as an oscillator whose frequency is determined by A3A1C17, A3A1R34, A3A1R36, and A3A1R37. The oscillator frequency is adjusted by varying A3A1R36. The oscillator output (pin 3) is fed to the D-type flip-flop A3A1U3 (pin 11). The output frequency of A3A1U3 is 1/2 that of the output of A3A1U4 as characterized by the flip-flop. The output of A3A1U3 (pin 13) is applied to the Schmitt trigger A3A1U2 through the MODULATION SELECTOR switch only in the INT SQ WAVE position. The bias supplies for A3A1U3 and A3A1U4 are tapped from the 40V supply in the same manner as for A3A1U2 (see paragraph 3-33). The bias supply is turned off when the INT SQ WAVE mode of operation is not used.

3-35. MODULATION SELECTION. The six-position MODULATION SELECTOR switch A3A1S1 selects the proper model of operation for the various functions. The klystron grid is biased so that it is held positive (approximately 10V) with respect to the cathode in CW, INT FM~, and EXT FM positions and is held to cut-off (approximately -30 volts with respect to the cathode) in the RF OFF and EXT ⊓⊔ positions. In the INT SQ WAVE position it is switched between +10 and -30 volts. The grid voltage is determined by the adjustment of A5A2R5 which in turn sets the beam current (see paragraph 3-46c). The circuit operation in each position of the MODULATION SELECTOR switch is described in paragraphs 3-36 through 3-41.

3-36. RF OFF POSITION. In the RF OFF position, the voltage at the input to the Schmitt trigger gate is returned to ground through the MODULATION SELECTOR switch. The output of the amplifier A3A1Q1 is, therefore, at ground potential (-355 ref gnd) and the grid is thus placed at a negative potential sufficient to drive the klystron into cut-off and thus inhibiting oscillation.

3-37. CW POSITION. In the CW position, the voltage at the input to the Schmitt trigger gate (pin 1 of A3A1U2) is held at +12V (with respect to -355V as referenced ground). The output of the amplifier is thus +40V and the grid is thus placed at a potential that permits the klystron to oscillate.

3-38. INT SQ WAVE POSITION. In the INT SQ WAVE position the input to the Schmitt trigger is fed from the output of flip-flop A3A1U3. The square wave output of the flip-flop moves the Schmitt trigger gate up and down at the same rate. The grid driven by the amplifier, therefore, modulates the klystron oscillations, producing a square wave modulation of output. The rate itself, is controlled by the setting of A3A2R36 which changes the frequency of the basic oscillator A3A1U4.

3-39. EXT ⊓⊔ POSITION. In the EXT ⊓⊔ position, the input to the Schmitt trigger gate is placed at ground potential (-355V) so that initially the klystron tube does not conduct. The input to the Schmitt trigger, however, is driven by positive going pulses from an external source applied at the EXT MOD connector J3. The klystron tube conducts only during that portion of the cycle when the pulse is on.

3-40. INT FM ~ POSITION. In the INT FM ~ position the Schmitt trigger is biased so that the output of the amplifier is at +40V; thus, the grid is at a potential so that oscillations in the klystron tube takes place. The voltage on the repeller electrode of the tube is modulated by a sine wave voltage as derived from the line voltage through transformer A2T1. The FM deviation is determined by resistor A3A3R16 and the rate is fixed at the line frequency. In addition, a horizontal sweep output is available at connector J1 whose phase can be varied by HOR SWP PHASE control resistor A3A3R4. With the use of the HOR SWP OUT and PHASE controls, the rf output modulation can be viewed on an oscilloscope with the aid of an RF detector.

3-41. EXT FM POSITION. In the EXT FM position, the oscillations take place as described in the INT FM ~ position. The repeller voltage is modulated by the external voltage applied at connector J2.

3-42. ΔF CONTROL. The ΔF control varies the repeller voltage over a relatively small range to provide a frequency vernier adjustment.

3-43. EXT AM CONNECTOR. An external amplitude modulating signal, when connected to the EXT AM connector at the rear of a Model 1105E-L or 1106E-L, is applied through a 2.7-kilohm resistor to attenuator AT1. If the external amplitude modulating signal is negative, it produces upward modulation; if positive, it produces downward modulation. Since attenuator AT1 is a PIN diode attenuator, it is an absorption device; therefore, it cannot actually increase the klystron power output, but can only reduce its own attenuation factor to a minimum. If a negative modulating signal is too large, therefore, it causes clipping of the rf output signal. To counteract this clipping effect, the bias applied to attenuator AT1 must be reduced, thereby increasing the average power output. Downward

modulation of approximately 15 dB is available. This is sufficient to approximate 100-percent modulation. The amount of distortion is a function of the percentage of modulation and is very low for up to 30-percent modulation.

3-44. BEAM (-325V), REPELLER (-825V), AND THE +40V (-355V) REF GROUND POWER SUPPLIES. The power supplies used for generation of beam, repeller and control circuits are not conventional. A block diagram of the processes by which high voltages are generated is shown in figure 3-2. A low voltage power supply (approximately 31V) is derived from the line voltage using a conventional, step-down transformer A2T1, bridge rectifier, and filter networks for low ripple. It supplies the main current for subsequent conversion to a high voltage ac generator. The dc voltage is converted to a low voltage, high frequency, ac power source (20 KHz, typical) by oscillator A5Q1 and A5Q2. The low ac voltage is stepped up to suitable ac voltages by transformer A5T2.

3-44A. LOW VOLTAGE DC POWER SUPPLY. The main ac line voltage is stepped down to approximately 31 vac and rectified using bridge rectifier A4BR1. The rectified voltage is filtered and the ripple is kep low using Darlington capacitor multiplier A4Q4 and A4Q5. Capacitor A4C1 provides the fundamental filtering. The effective capacitance of A4C2 is increased by the current gains of A4Q4 and A4Q5.

3-44B. LOW VOLTAGE HIGH FREQUENCY AC VOLTAGE GENERATOR. The dc voltage as generated in paragraph 3-44A is subsequently converted into low ac voltage at a high frequency as follows. Two PNP transistors A5Q1 and A5Q2, and transformer A5T1 comprise the basic oscillator. The meitter is connected to the +31V dc line through the current limiter A4Q1. The bias voltage to the bases is determined by the collector voltage of transistor A4Q3. The collector voltage of A4Q3 is set initially (before A5Q1 and A5Q2 oscillate or the time delay is over) by BIAS ADJ resistor A4R4. Resistor A4R4 is in the base-emitter circuit of A4Q2; hence, it sets the voltage for the collector of A4Q2 or emitter of A4Q3. Initially the emitter of A4Q3 is set at approximately 11V so that A5Q1 and A5Q2 do not oscillate. (The emitter to base voltage of A4Q3 is thus <0.7 volts.) The base voltage of A4Q3 is determined by the output of voltage regulator A4U3 which is a monolithic integrated circuit. The voltage between the NON-INVERTING (pin 3) and INVERTING (pin 2) inputs of A4U3 is amplified internally by A4U3 and appears at pin 6, which in turn is connected to the base of A4Q3 through load resistor A4R9. Pin 10 of A4U3 is biased with resistors A4R16 and A4R17 such that the regulator does not regulate initially. The junction of A4R16 and A4R17 is approximately 0.8V initially. When the delay time is over, this junction voltage changes to zero volts and the regulator starts to regulate. The output at pin 6, which is determined by the voltage difference between pins 2 and 3, is such that A4Q3 conducts and in turn A5Q2 and A5Q2 starts to oscillate. The amplitude of the oscillations is adjusted by A4R21. (When A4R21 is adjusted, the base voltage of A4Q3 varies and this in turn varies the base current of A5Q1 and A5Q2 and hence the amplitude of the oscillations.) Voltage reference for pin 2 is derived from the fixed voltage regulator A4U2. Constant voltage is maintained at pon 6 and hence that of the oscillations amplitude by A4U3 which senses any variation of the difference in voltages between pins 2 and 3. Pin 2 is fixed by the resistor network A4R19, A4R21, and A4R22 and at pin 3 voltage is derived by feedback network A4R18 and A5A1R7. If there is any variation at pin 3 due to load or line voltages, the regulator will correct all changes through its feedback loop and maintain a constant amplitude of oscillation. A4CR1 is added for the protection of A4Q2 and diodes A5CR1 to A5CR4 are added for the protection of A5Q1 and A5Q2.

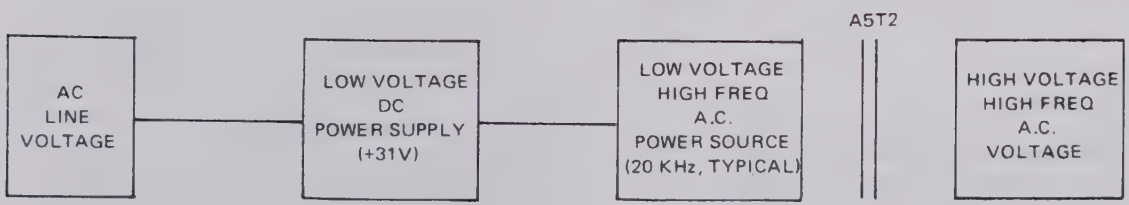


Figure 3-2. High Voltage Generation, Block Diagram

3-44C. HIGH VOLTAGE — HIGH FREQUENCY AC VOLTAGE. The output of the basic oscillator (low voltage, high frequency) is stepped up through transformer A5T2 to suitable values.

3-44D. BEAM POWER SUPPLY. High voltage fast switching rectifier diodes A5A1CR9 to A5A1CR12 rectify the high voltage ac appearing across pins 9 and 10 of the transformer A5T2. After suitable filtering, it is applied to the klystron cathode (-325V).

3-44E. THE REPELLER VOLTAGE. AC voltage appearing across pins 4 and 5 of the transformer is rectified by diodes A5A2CR5 to A5A2CR8 and applied to the voltage regulator netrowk A3A1CR8, A3A1CR9 to A3A1CR12, A3A1Q2 and A3A1Q3. A3A1CR8, A3A1CR9 to A3A1CR12 are zener diodes which establish a reference voltage for the regulator A3A1Q2 and A3A1Q3 are used in a Darlington arrangement to provide the necessary regulation. The ground repeller supply is referenced to the -325 beam supply.

3-44F. THE +40 V SUPPLY FOR CONTROL CIRCUITS. The bridge rectifier A5BR1 rectifies the ac voltage across pins 11 and 12 of transformer A5T2. This +40V is applied to the op-amp A5A2U1 whose output floats at -325V. The output of the op-amp is connected to the inverting input (pin 2) of the op-amp and the non-inverting input is floating and can be varied from 0 to 32 volts (32 volts appearing across zener diode A5A2CR15) by resistor A5A2R5 and thus the entire +40V supply floats at -325V.

3-45. KLYSTRON FILAMENT SUPPLY. The klystron filament is supplied with regulated dc voltage to minimize drift and incidental amplitude and frequency modulation. The klystron filament supply consists of bridge rectifier A3A1BR1 and voltage regulator A3A1U1. It is referenced to the -325V beam supply. The filament voltage is adjusted to 6.3V by potentiometer A3A1R1.

3-46. POWER SUPPLY ADJUSTMENTS. The power supplies are provided with three adjustments which are described below:

a. -325V ADJ CONTROL. The -325V ADJ control A4R21 sets the operating point for control amplifier A4U3 which maintains the beam power supply at its set value.

b. -825V ADJ CONTROL. The -825V ADJ control A3A1R2 sets the operating point for regulator A3A1Q2 and A3A1Q3 which maintains the repeller power supply at its set value.

c. BEAM CURRENT ADJ control. The BEAM CURRENT ADJ control A5A2R5, which has a range of approximately 32 volts, adjusts the beam current through the klystron. The beam current is measured by monitoring the voltage across A5A1R8 which appears between A4TP2 and A4TP4.

SECTION IV

MAINTENANCE

4-1. GENERAL

4-2. This section contains maintenance and alignment procedures for the Modular Microwave Signal Generators and Sources, Models 1105E, 1106E, 1105E-L, 1106E-L, 1205E, and 1206E. Included in this section are a list of test equipment required, minimum performance standards for the instruments, a troubleshooting procedure, and the alignment procedures required for the instruments.

4-3. TEST EQUIPMENT REQUIRED

4-4. Table 4-1 lists the test equipment required for the maintenance of Models 1105E, 1106E, 1105E-L, 1106E-L, 1205E, and 1206E. Test equipment of equivalent characteristics may be substituted for the items listed.

4-5. PRELIMINARY INSPECTION

4-6. Perform a preliminary visual and manual inspection of the instrument before undertaking any maintenance procedure. Remove the top and bottom dust covers of the instrument to inspect its interior. Look for loose or damaged parts, dust, dirt, oil or grease, and corrosion. Correct such conditions before proceeding with maintenance.

WARNING

THE STABILIZER INPUT TERMINAL BOARD, ON THE REAR PANEL, HAS A REGULATED POTENTIAL OF 825 VOLTS DC ON ITS TERMINALS. SEVERE SHOCK OR DEATH MAY RESULT FROM ACCIDENTAL CONTACT WITH THESE TERMINALS. THE TERMINALS ARE COVERED TO PREVENT ACCIDENTAL CONTACT. THE COVER SHOULD NOT BE REMOVED UNLESS AN EXTERNAL LOCK BOX IS TO BE CONNECTED.

CAUTION

DO NOT DISTURB ANY ADJUSTMENTS ON COMPONENTS OF THE KLYSTRON OSCILLATOR CASTING. A COMPLETE REALIGNMENT MAY BE REQUIRED IF ANY ADJUSTMENTS ARE TOUCHED.

4-7. MINIMUM PERFORMANCE STANDARDS

4-8. The minimum performance standards listed in table 4-2 will determine whether the instrument is operating within the specification limits listed in table 1-2.

4-9. TROUBLESHOOTING

4-10. The troubleshooting procedure for the instrument is given in table 4-3. If the location of the trouble is indefinite or cannot be localized, start the troubleshooting procedure at the step that most closely resembles the trouble encountered.

WARNING

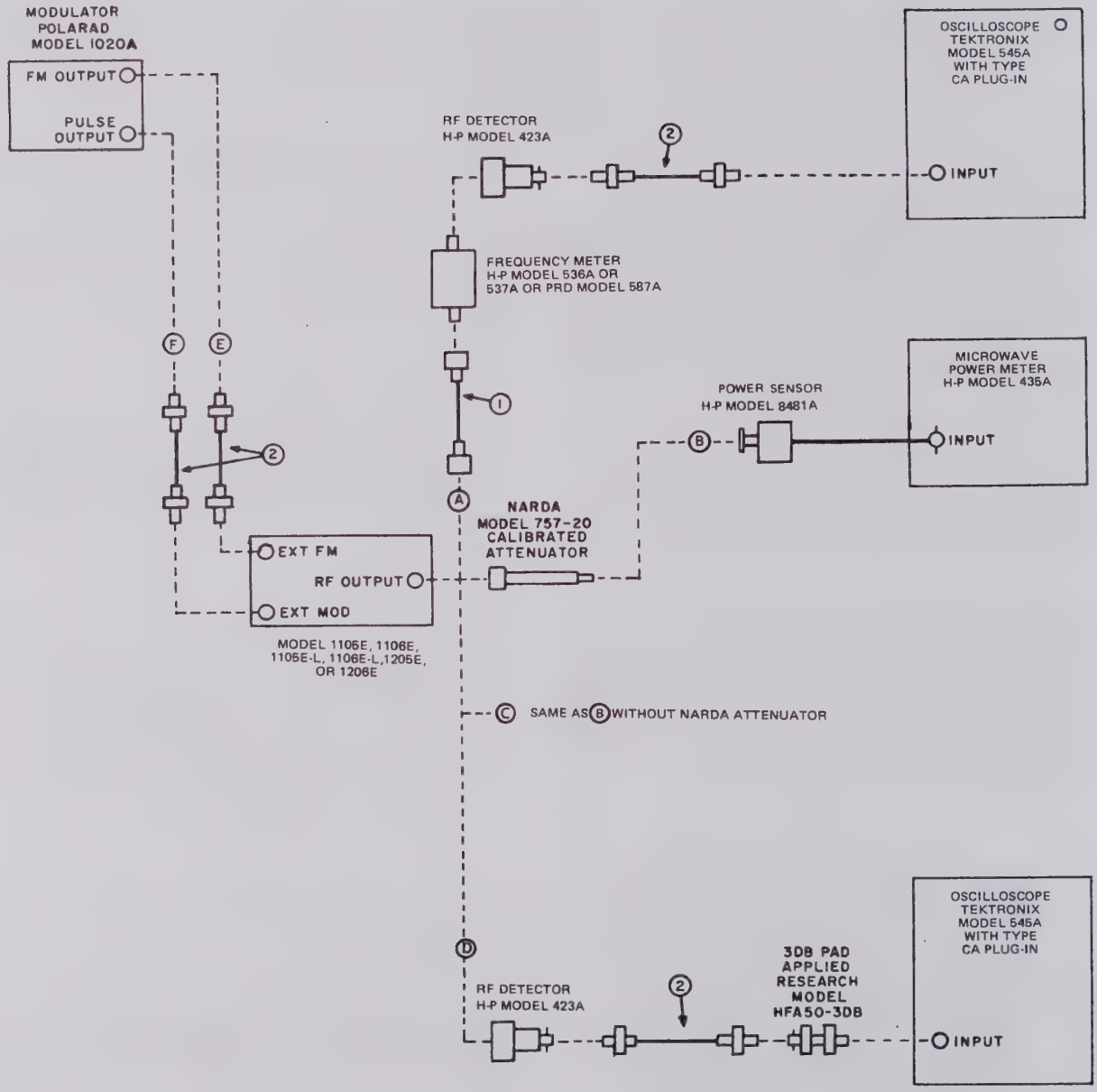
A REGULATED DC VOLTAGE OF 825 VOLTS WILL BE ENCOUNTERED DURING THE TROUBLESHOOTING TESTS. DO NOT CONNECT OR DISCONNECT TEST EQUIPMENT WHICH CONNECTS INTERNALLY WITH THE INSTRUMENT ENERGIZED.

4-11. DISASSEMBLY AND REASSEMBLY INSTRUCTIONS

4-12. Disassembly and reassembly instructions for the instrument are given in paragraphs 4-13 through 4-17. Component locations are shown in figures 4-8 through 4-14.

Note

Do not disassemble the instrument beyond the point at which the necessary repair or replacement can be made. Perform the applicable minimum performance checks of table 4-2 after any replacement procedure.



(1) RF CABLE P/N B12551 SUPPLIED AS ACCESSORY

(2) VIDEO CABLE

(A) FREQUENCY ACCURACY

(B) POWER OUTPUT TESTS

(C) ATTENUATOR ACCURACY TESTS

(D) INTERNAL SQUARE WAVE AND FM TESTS

(E) EXTERNAL FM TESTS

(F) EXTERNAL PULSE TESTS

Figure 4-1. Minimum Performance Standards Test Setups

TABLE 4-1. TEST EQUIPMENT REQUIRED

Name	Manufacturer and Model No.	Use
FREQUENCY METER	H/P 537A (3.70 to 12.4 GHz) H/P 536A (0.96 to 4.2 GHz) PRD 587A (0.40 to 1.0 GHz)	Frequency tests
MODULATOR	Polarad Model 1020A	External modulation tests
MULTIMETER, DIGITAL	Fluke Model 8000A	Voltage, current, and resistance tests
OSCILLOSCOPE	Tektronix Model 545A with Type CA plug-in	Frequency, square wave, and pulse tests
PAD, 3 db	Applied Research Model HFA50-3DB	Square wave and pulse tests
PAD, 20 db	Narda Model 757-20	Power output tests
POWER METER WITH SENSOR	Hewlett-Packard Model 435A and 8481A	Power output and attenuator tests
RF DETECTOR	Hewlett-Packard Model 423A	Klystron mode alignment, square wave and pulse tests
SPECTRUM ANALYZER	Polarad Model 640A	FM tests
ADAPTOR SMA(F) to N(F)	Sealectro 50-672-670-89	Probe alignment of 1105E-L and 1106E-L only
POWER SUPPLY	Power Design TW 4005	Amplifier and op-amp tests

4-13. REMOVAL OF SIGNAL GENERATOR POWER SET PROBE ASSEMBLY. To remove power set probe assembly from Models 1105E, 1106E, 1105E-L and 1106E-L (see figure 4-8), proceed as follows:

a. Rotate POWER SET or POWER SET/AUTO-LEVEL SET control and ATTENUATOR control fully clockwise.

b. Unfasten and remove the cable clamp that, if present, secures the power set probe cable W9 (for 1105E and 1106E) or W27 (for 1105E-L and 1106E-L).

c. Disconnect power set output probe connector P7 (for 1105E and 1106E) or P12 (for 1105E-L and 1106E-L).

d. Loosen the setscrews that secure the power set probe in the probe block.

e. Carefully slide the probe straight out of the power set barrel on the klystron cavity, noting the direction of the ground stub at the end of the probe. When reinserting the probe, the scribe lines on the barrel and the probe must be aligned so that the ground stub is always in the same direction. For the 1105 series orientation of the probe is not necessary and for the 1106 series it faces the rear of the unit.

f. Remove the power set probe assembly from the instrument.

TABLE 4-2. MINIMUM PERFORMANCE STANDARDS

Step	Purpose	Procedure	Normal Indication*	Abnormal Indication Ref.
1	Evaluate power operating conditions	Connect instrument under test to power source and set POWER switch to ON.	POWER indicator lights when power is applied. Delay circuit operates after approximately 60 seconds	Check DS1, A1F1, A1S1, power cable, and setting of 115/230 volt switch A1S2. Check A4U1 and associated components.
2	Evaluate POWER SET operation (1105E, 1106E, 1105E-L and 1106E-L only)	Adjust the instrument under test for CW operation at low end of frequency range. Refer to paragraph 2-10. Tune thru the frequency band resetting the POWER SET control for CAL. 1105E and 1105E-L: 0.8 to 2.4 GHz 1106E and 1106E-L: 1.8 to 4.6 GHz	Power monitor meter deflects to CAL.	See table 4-3 step 3A
3A	Evaluate maximum power output (1105E, 1105E-L, 1106E and 1106E-L)	Connect test equipment as shown in figure 4-1 test setup B. At the frequencies listed below, check for maximum uncalibrated power output. Set POWER SET control fully counterclockwise. 1105E and 1105E-L: 1.2, 1.5, 2.0 1106E and 1106E-L: 2.2, 3.0, 4.0	The uncalibrated power output > 10 dBm	Refer to paragraph 4-15

*NOTE: All specifications are based upon clockwise rotation of controls.

TABLE 4-2. MINIMUM PERFORMANCE STANDARDS (Continued)

Step	Purpose	Procedure	Normal Indication*	Abnormal Indication Ref.
3B	Evaluate maximum power output (1205E and 1206E)	Repeat step 3A and check for maximum power output at the frequencies listed below. 1205E: 1.2, 1.5, 2.0 1206E: 2.2, 3.0, 4.0	50 mw, minimum	Refer to paragraph 4-15
4	Evaluate attenuator accuracy (1105E, 1105E-L, 1106E and 1106E-L only)	Connect test equipment as shown in figure 4-1 test setup C. At the frequencies listed below, check attenuator accuracy at +3.0, -5, -10, -15, and -20 dBm. 1105E and 1105E-L: 1.0, 1.5, 2.0 1106E and 1106E-L: 2.0, 3.0, 4.0	±2 dB absolute accuracy	Refer to paragraph 4-15
5	Evaluate frequency readout accuracy	Connect test equipment as in figure 4-1 test setup A and set attenuator for -15 dBm. Adjust frequency meter, for dip, to determine signal frequency at the following FREQUENCY GHz readout settings.	Frequency meter reading is within ±5 MHz on on Model 1105E-L and ±10 MHz on Model 1106E-L of FREQUENCY GHz readout.	Refer to paragraph 4-25

*NOTE: All specifications are based upon clockwise rotation of controls.

TABLE 4-2. MINIMUM PERFORMANCE STANDARDS (Continued)

Step	Purpose	Procedure	Normal Indication*	Abnormal Indication Ref.
5 Cont.		1105E / 1105E-L / 1205E: 0.80, 0.95, 1.40, 1.60, 1.80, 2.00, 2.40 1106E / 1106E-L / 1206E: 1.80, 2.00, 2.20, 2.40, 3.00, 3.40, 3.80, 4.00, 4.20, 4.40, 4.60 **Note** Set ΔF control at '0'. Models 1105E-L and 1106E-L are tested in leveled mode of operation.	1105E-L Limits: 0.795 to 0.805; 0.945 to 0.955; 1.395 to 1.405; 1.595 to 1.605; 1.795 to 1.805; 1.995 to 2.005; 2.395 to 2.405 1106E-L Limits: 1.790 to 1.810; 1.990 to 2.010; 2.190 to 2.210; 2.390 to 2.410; 2.990 to 3.010; 3.390 to 3.410; 3.790 to 3.810; 3.990 to 4.010; 4.190 to 4.210; 4.390 to 4.410; 4.590 to 4.610 1105E, 1106E, 1205E, 1206E, ±0.5% + Frequency Pulling. (see figure 1-3).	
6	Evaluate internal square wave operation	Connect test equipment as shown in figure 4-1, test setup D. Set MODULATION SELECTOR switch to INT SQ. WAVE and vary INT SQ. WAVE control. Check square wave frequency with oscilloscope.	Square wave frequency varies from 950 to 1050 Hz, minimum	Set table 4-3, step 12A or 12B.
7	Evaluate internal FM operation	a. Connect test equipment as shown in figure 4-1, test setup D.		See table 4-3, step 13.

*NOTE: All specifications are based upon clockwise rotation of controls.

TABLE 4-2. MINIMUM PERFORMANCE STANDARDS (Continued)

Step	Purpose	Procedure	Normal Indication*	Abnormal Indication Ref.
7 cont.		b. Connect the HOR SWP OUT to the EXT SWEEP IN of the oscilloscope. c. Set oscilloscope HORIZONTAL for EXT SWEEP mode. d. Set the EXT SWEEP ATTEN so that it fills the entire horizontal sweep. e. Set the MODULATION SELECTOR switch to INT FM ~. f. Vary the INT FM DEV control.	The entire mode should be swept and the pattern should look like fig. 4-5C, when properly phased using the HOR SWP PHASE control. **Note** The sweep may not be symmetrical about the center frequency.	
8	Evaluate external FM operation	a. Set unit for CW operation (see para. 2-10). b. Connect an rf cable between RF OUTPUT and RF INPUT of 840A Spectrum Analyzer. c. Locate and center the signal on the analyzer. d. Connect the FM OUT of 1020A modulator to EXT FM connector. e. Set the MODULATION SELECTOR switch to EXT FM. f. Vary the FM AMPLITUDE control on 1020A modulator.	FM sweep of at least 1 MHz, typical, should be obtained.	See table 4-3, step 14

*NOTE: All specifications are based upon clockwise rotation of controls.

TABLE 4-2. MINIMUM PERFORMANCE STANDARDS (Continued)

Step	Purpose	Procedure	Normal Indication*	Abnormal Indication Ref.
9	Evaluate external pulse operation	Connect test equipment as shown in figure 4-1, test setups D and F. Set MODULATION SELECTOR switch to EXT ⎍ ⎍. Set PULSE WIDTH and RATE controls on 1020A Modulator to desired values. Observe pulses on oscilloscope.	Steady pulses with set pulse width and rate should be observed. Note Using Model 1020A as the external pulse source, the modulation duty cycle will be exceeded if a pulse rate higher than approximately 350 Hz is used at the maximum delay of 2000 μsec.	See table 4-3, step 15
10	Evaluate Automatic Leveling (Models 1105E-L and 1106E-L only)	Connect test equipment as shown in figure 4-1 test setup B, place AUTO-LEVEL switch to ON, place POWER SET/ AUTO-LEVEL SET control so that red line lines up with red line on panel, and adjust AUTO-LEVEL CAL control for power monitor indication of CAL. Set MODULATION SELECTOR switch to CW and vary FREQUENCY GHz dial from one extreme to the other. Check power output with power meter at 0 dBm.	Leveled output is uniform within ±0.75 dB (Model 1105E-L) or ±1.0 dB (Model 1106E-L)	See table 4-3, step 3B

*NOTE: All specifications are based upon clockwise rotation of controls.

TABLE 4-3. TROUBLESHOOTING PROCEDURE

Step	Symptom	Procedure	Normal Indication	Abnormal Indication Corrective Ref.
1	Power indicator lamp does not light up.	Paragraph 2-9	Power indicator lamp lights up.	Check line cord B160833, fuse A1F1, AC VOLTAGE SET switch A1S2, ON/OFF switch A1S1, transformer A2T1 and discharge lamp DS1.
2	Delay circuit inoperative	a. Turn POWER to ON. b. Connect common of Fluke 800A to ground and V-Ω lead to A4TP3 and measure the voltage on 2 V range.	Voltage measured should be 0.8 ± 10% volts before the delay is over and 0 volt after the delay period is over. (Delay period is approximately 60 seconds.)	a. Check A4U1 and associated circuitry. b. Check A4U3.
3A	No CW operation	Paragraph 2-10	a. Presence of RF OUTPUT as indicated by CAL deflection or as meaured by power meter at RF OUTPUT connector	a. If no RF INPUT (all models), check 1. Fuse A4F1 2. Fuse A4F2 3. Fuse A3A1F1 (deleted in new version) 4. Filament voltage — see step 4 5. Oscillator power supply voltage — see step 5 6. Beam supply voltage — see step 6 7. Repeller supply voltage — see step 7 8. Amplifier circuits supply voltage—see step 8 9. Beam current — see step 9 10. Amplifier circuits —see step 10

TABLE 4-3. TROUBLESHOOTING PROCEDURE (Continued)

Step	Symptom	Procedure	Normal Indication	Abnormal Indication Corrective Ref.
3A cont.				11. Klystron tube V1 12. Mode tracking – see para. 4-26 for mode tracking 13. Table 5-1 for voltage and resistance values listed 14. RF attenuator probe 15. Tracking pot A7R1 b. If presence of RF OUTPUT but no meter CAL (Models 1105E, 1105E-L, 1106E and 1106E-L only) is observed; check: 1. Level detector Z1 2. power monitor meter A8M1 3. POWER SET/AUTO-LEVEL set probe 4. Meter CAL adjust A3A1R31 and associated circuitry
3B	No or incorrect auto-leveling operation (Models 1105E-L and 1106E-L only)	Connect test equipment as shown in figure 4-1 test setup B, place AUTO-LEVEL switch to ON, place POWER SET/ AUTO-LEVEL SET control so that red line lines up with red line on panel, and adjust AUTO-LEVEL CAL control for power monitor indication of CAL.	Leveled output is uniform within ±0.75 dB (Model 1105E-L) or ±1 dB (Model 1106E-L)	a. Check attenuators AT1 and AT2. b. Check leveling circuit board A11. See para. 4-28 for more details.

TABLE 4-3. TROUBLESHOOTING PROCEDURE (Continued)

Step	Symptom	Procedure	Normal Indication	Abnormal Indication Corrective Ref.
3B cont.		Set MODULATION SELECTOR switch to CW and vary FREQUENCY GHz dial from one extreme to the other. Check power output with power meter at 0 dBm		
4	Check filament voltage	Measure voltage between pins 2 and 3 of connector A3A1J3 (pin 3 as ground) using Fluke 8000A on 20 volt range	+6.3 volts ±10%	a. See paragraph 4-23 for adjustment of filament voltage b. Check A3A1BR1, A3A1U1 and associated circuitry.
5	Check oscillator power supply voltage	a. Disconnect A5P11 from A4J2. b. Turn unit ON and measure the voltage between ground and A4TP1 using Fluke 8000A in 200 V range	35 ± 2 volts (for line voltage of 115 VAC)	a. Check fuse A4F1. b. Check A4BR1 and associated circuitry.
6	Check beam supply voltage	Connect common of Fluke 8000A to chassis ground and V-Ω lead to pin 3 of A3A1J3. Measure voltage on 1200 V range	-325 ±1% volts.	a. See paragraph 4-20 for adjustment of -325 volts. b. Check voltage regulator A4U3. c. Check A5A2Q1, A5A2Q2 and their associated circuitry. d. Check A5A1CR9 thru A5A1CR12 and their associated circuitry.

TABLE 4-3. TROUBLESHOOTING PROCEDURE (Continued)

Step	Symptom	Procedure	Normal Indication	Abnormal Indication Corrective Ref.
6 cont.				**Note** If the repeller (-825V) and the amplifier circuits (40 volt) supplies are not operating properly, they will effect the beam (-325V) supply. It is only after checking all three supplies that final check of beam supply can be made.
7	Check repeller supply voltage	Connect Fluke multimeter 8000A COMMON lead to chassis ground and V-Ω lead to pin 3 of connector A3A1J5. Measure voltage on 1200 V range. Turn ΔF control fully clockwise. **Note** Return ΔF control to "0" position after the measurement.	-825 ± 1% volts.	a. See para. 4-21 for adjustment of -825 volts. b. Check A5A2CR5 thru A5A2CR8 and their associated circuitry. c. Check A3A1Q2, A3A1Q3, A3A1CR8 thru A3A1CR12 and their associated circuitry.
8	Check the amplifier circuits 40 volt supply voltage	Connect the V-Ω lead of Fluke 8000A to pin 3 of A3A1J8 and common lead to pin 4 of A3A1J8 and measure voltage on 200 V range	+40 ± 10% volts	Check A5A1BR1 and associated circuitry.

TABLE 4-3. TROUBLESHOOTING PROCEDURE (Continued)

Step	Symptom	Procedure	Normal Indication	Abnormal Indication Corrective Ref.
9	Check beam current	Connect V-Ω lead of Fluke 8000A digital multimeter to to A4TP4 and COMMON to chassis ground and measure voltage.	2.00 ±20% volts: 1105 series 3.50 ±20% volts: 1106 series	a. See para. 4-22 for adjustment of beam current. b. Check amplifier A3A1Q1 circuitry – see step 10. c. Check op-amp A5A2U1 and associated circuitry – see step 11.
10	Check amplifier circuitry	Turn the POWER of unit to OFF. Connect externally positive of DC power supply (Power Design TW-4005) to pin 3 and negative to pin 4 of connector A3A1J8. Measure the voltage between pin 1 and pin 4 of connector A3A1J3 using Fluke 8000A multimeter (pin 4 should be connected to COMMON).	The measured voltages should be as follows when appropriate MODULATION SELECTOR switch is depressed: a. RF OFF – 0 volts b. CW – 40 ± 10% volts c. INT SQ WAVE – 20 ± 20% volts d. EXT ⊓⊓ – S/A a e. INT FM ~ – S/A b f. EXT FM – S/A b	1. If measured voltages in RF OFF and CW positions are same, check A3A1U2. 2. If measured voltage in CW position is less than 30 volts, check A3A1Q1 and associated circuitry. 3. If measured voltages in RF OFF and CW positions are correct, check switch A3A1S1 for abnormality observed in positions of EXT ⊓⊓, INT FM ~, and EXT FM. 4. If measured voltages in CW and RF OFF positions are correct, check A3A1U3, A3A1U4 and their associated circuitry for INT SQ WAVE position – see step 12

TABLE 4-3. TROUBLESHOOTING PROCEDURE (Continued)

Step	Symptom	Procedure	Normal Indication	Abnormal Indication Corrective Ref.
11	Check Op-Amp (A5A2U1 circuitry)	Set the POWER switch to OFF. Disconnect A5P10 from A3A1J8. Connect +lead of external power supply Power Design TW4005 to pin 3 and —lead to pin 4 of A5P10. Measure voltage between pins 2 and 3 of A5P10 (pin 2 as ground) as the BEAM CURRENT ADJ. A5A2R5 is varied. **Note** Return A5A2R5 to original value. See para. 4-22 for adjustment of A5A2R5.	The measured voltage should vary between 7 to 30 volts ± 20%	Check A5A2U1 and associated circuitry.
12A	No internal square wave operation (Models 1105E, 1106E, 1105E-L, 1106E-L only)	a. Connect test equipment as shown in figure 4-1, test setup D. b. Set FREQUENCY GHz dial to mid-range. c. Adjust POWER SET control for a power monitor indication of CAL. d. Set MODULATION SELECTOR switch to INT SQ WAVE. e. Vary INT SQ WAVE control over its range.	a. Square wave rate varies typically from 950 to 1050 Hz. b. Power monitor meter indication drop to −3 approximately (Models 1105E and 1106E only).	Check A3A1U3, A3A1U4 and associated circuitry.

TABLE 4-3. TROUBLESHOOTING PROCEDURE (Continued)

Step	Symptom	Procedure	Normal Indication	Abnormal Indication Corrective Ref.
12B	No internal square wave operation (Models 1205E and 1206E)	a. Connect test equipment as shown in figure 4-1, test setup D. b. Set FREQUENCY GHz dial to mid-range. c. Adjust ATTENUATOR control on Models 1205E/ 1206E for an indication of 1 milliwatt. d. Set MODULATION SELECTOR switch to INT SQ WAVE. e. Vary INT SQ WAVE control over its range.	Square waves with a frequency range of 950 to 1050 Hz should be observed.	Check A3A1U3, A3A1U4 and associated circuitry.
13	No internal fm operation	a. Connect test equipment as shown in figure 4-1, test setup D. b. Connect the HOR SWP OUT to the EXT SWEEP IN of the oscilloscope. c. Set oscilloscope HORIZONTAL DISPLAY to EXT SWEEP mode. d. Set the EXT SWEEP ATTEN so that it fills the entire horizontal sweep. e. Set the MODULATION SELECTOR switch to INT FM ~. f. Vary the INT FM DEV control.	The entire mode should be swept and the pattern should be like figure 4-5C, when properly phased using the HOR PHASE control.	Check A2T1, A3A3R16, A3A1S1 and associated circuitry.

TABLE 4-3. TROUBLESHOOTING PROCEDURE (Continued)

Step	Symptom	Procedure	Normal Indication	Abnormal Indication Corrective Ref.
14	No external fm operation	a. Set unit for CW operation (see para. 2-10). b. Connect an rf cable between RF OUTPUT and RF INPUT of 640A Spectrum Analyzer. c. Locate and center the signal on the analyzer. d. Connect the FM OUT of 1020A modulator to EXT FM connector. e. Set the MODULATION SELECTOR switch to EXT FM. f. Vary the FM AMPLITUDE control on 1020A modulator.	FM sweep of at least 1 MHz typical should be obtained.	Check A3A1S1 and associated circuits.
15	No external pulse operation	a. Connect test equipment as shown in figure 4-1, test setups D and F. b. Set MODULATION SELECTOR switch to EXT c. Set PULSE WIDTH and RATE controls on Model 1020A Modulator to any desired value. Observe pulses on oscilloscope.	Steady pulses with set pulse width and rate should be observed. **Note** Using Model 1020A as the external pulse source, the modulation duty cycle will be exceeded if a pulse rate higher than approximately 350 Hz is used at the maximum delay of 2000 μsec.	Check A3A1S1, A3A1Q1, A3A1U2 and associated circuitry.
16	CW operation OK but DB ERROR or rate of attenuation N/G	a. Connect test equipment as shown in figure 4-1, test setup B. b. Set MODULATION SELECTOR to CW. c. Vary ATTENUATOR control.	Power meter indication will vary in unison with rotation of ATTENUATOR control.	Refer to paragraphs 4-14 and 4-15.

TABLE 4-3. TROUBLESHOOTING PROCEDURE (Continued)

Step	Symptom	Procedure	Normal Indication	Abnormal Indication Corrective Ref.
17A	Check RF OFF function (Models 1105E, 1106E, 1105E-L and 1106E-L only)	a. Connect test equipment as shown in figure 4-1, test setup B. b. Set MODULATION SELECTOR switch to RF OFF.	Power monitor and power meter indicate zero.	Adjust mechanical zero adjustment of A8M1. Check A3S1 circuits.
17B	Check RF OFF function (Models 1205E, 1206E)	Same as step 17A test setup B.	Power meter indicates zero.	Check A3A1S1 circuits.
18	Frequency out of spec.	Connect test equipment as shown in figure 4-1, test setup A. Adjust frequency meter, for dip, to determine signal frequency at the following FREQUENCY GHz readout settings: 1105E, 1105E-L, 1205E: 0.80, 0.95, 1.40, 1.60, 1.80, 2.00, 2.40 1106E, 1106E-L, 1206E: 1.80, 2.00, 2.20, 2.40, 3.00, 3.40, 3.80, 4.00, 4.20, 4.40, 4.60 **Note** Set ΔF control at zero and rf output at less than −6 dBm leveled or unleveled mode of operation. Models 1105E-L and 1106E-L are tested in leveled mode of operation.	Frequency meter reading is within ±5 MHz on Model 1105E-L and ±10 MHz on Model 1106E-L of FREQUENCY GHz readout. 1105E-L Limits: 0.795 to 0.805; 0.945 to 0.955; 1.395 to 1.405; 1.595 to 1.605; 1.795 to 1.805; 1.995 to 2.005; 2.395 to 2.405 1106E-L Limits: 1.790 to 1.180; 1.990 to 2.010; 2.190 to 2.210; 2.390 to 2.410; 2.990 to 3.010; 3.390 to 3.410; 3.790 to 3.810; 3.990 to 4.010; 4.190 to 4.210; 4.390 to 4.410; 4.590 to 4.610 1105E, 1106E, 1205E, 1206E: ±0.5% + Frequency Pulling. (See figure 1-3.)	See para. 4-25 for frequency alignment.

4-14. REPLACEMENT OF SIGNAL GENERATOR POWER SET PROBE ASSEMBLY. To replace the power set probe assembly of the Models 1105E and 1106E proceed as follows:

a. Rotate POWER SET control and ATTENUATOR control fully clockwise.

b. Insert the probe end through the probe block into the power set barrel on the klystron cavity. The ground of the probe must be inserted so that it has the same orientation that it had before removal. To accomplish this, align the scribe line on the power set probe, which causes the ground stub to assume the correct orientation. The ground stub on the tip of the probe should always be facing to the rear for Model 1106E. Orientation of the probes are not necessary for the Model 1105E.

CAUTION

ADVANCING THE POWER SET PROBE TOO DEEPLY INTO THE KLYSTRON CAVITIES WILL DAMAGE THE PROBE.

c. For insertion of Models 1105E-L and 1106E-L probes, proceed to paragraph 4-27.

d. For the 1105E and 1106E, proceed as directed in steps e through l.

e. Adjust A3A1R31, METER CAL potentiometer, to its mid-range.

f. Connect probe connector P7 to the microwave power meter (figure 4-1, test setup B).

g. Tune the instrument over its range and determine the frequency at which minimum power output occurs.

h. Reconnect P7 to J7, on level detector Z1.

i. With instrument tuned to the frequency at which minimum power output is obtained, adjust amount of probe insertion in barrel for an indication of CAL on the power monitor meter.

j. Tighten the setscrew that secures the power set probe in the probe block.

4-15. REMOVAL OF ATTENUATOR PROBE ASSEMBLY. To remove the attenuator probe assembly (see figure 4-8), and proceed as follows:

a. Loosen setscrews in attenuator probe collar.

b. Repeat the procedures in paragraph 4-13a.

c. Unfasten and remove the cable clamp that secures the attenuator to the casting.

d. For the 1105E and 1106E, remove the screws mounting connector J5 to the front panel and then remove the probe assembly from the instrument.

e. For the 1105E-L and 1106E-L, remove the four screws holding the level box to the chassis, disconnect P10 and remove the probe assembly from the instrument.

4-16. REPLACEMENT OF ATTENUATOR PROBE ASSEMBLY. For Models 1105E-L and 1106E-L, proceed to paragraph 4-17. To replace the attenuator probe assembly on all other units, proceed as follows:

a. Rotate ATTENUATOR control fully clockwise.

b. Insert the probe tip through the probe collar and into the attenuator barrel, orienting the probe so that the scribe line is aligned with the scribe line on the barrel, to ensure that the ground stub is properly oriented (see paragraph 4-13e). The probe of the Models 1106E and 1206E is oriented so that the ground stub on the tip faces the rear. For Models 1105E and 1205E, orientation of the probe is not necessary. Tighten the setscrews on the probe collar.

c. Mount and fasten RF OUTPUT connector J5.

d. Replace cable clamp.

e. Connect microwave power meter to the instrument (fig. 4-1, test setup B) and check maximum power output across the frequency range. If the power is below specification, it might be necessary to rotate or change the klystron tube. Be sure to check pulsing after maximum power is obtained.

f. Tune the generator to the midpoint of its frequency range and rotate the ATTENUATOR dial counterclockwise until RF output is 0 dBm.

g. Loosen the setscrews on the attenuator dial hub and rotate the sliding dial to line up 0 dBm marking on the dial with the power set hairline.

h. Tighten the setscrews on the attenuator dial hub.

i. Tune the signal generator across the entire frequency range. Note the highest and lowest output points with reference to 0 dBm.

j. Using the two reference points measured in step i, adjust the output accuracy at 0 dBm (release setscrew and slide attenuator dial) so that the two reference points are equidistantly centered around 0 dBm.

k. After the desired results are obtained, lock both setscrews.

l. Adjust the signal generator frequency to midpoint on the band.

m. Check output accuracy at 0 dBm and −50 dBm. If a

compromise between the two power levels is necessary, adjust the the attenuator dial or A3R31.

n. Adjust the signal generator frequency to several points above and below the reference established in step l.

o. Repeat step m. for a compromise in the output frequency reference points established in step n.

p. Disconnect the power meter.

4-17. REPLACEMENT OF KLYSTRON OSCILLATOR TUBE V1. To replace klystron oscillator tube V1, (figure 4-2) proceed as follows:

WARNING

DO NOT ATTEMPT TO REPLACE THE KLYSTRON WITH THE INSTRUMENT OPERATING. DISCONNECT THE INSTRUMENT POWER CORD BEFORE KLYSTRON REPLACEMENT.

a. Loosen klystron cover holding clamp and remove cover carefully. Disconnect klystron socket from tube.

b. Rest the instrument on its front handles and hold secure in this position.

c. Loosen the knurled nut with a spanner wrench (Polarad P/N A15550, which was originally supplied).

d. Remove the knurled nut.

e. Extract the old klystron from the cavity by screwing the klystron clockwise and pulling out of cavity at the same time.

f. Remove the spacer and spring. Remove the spring from the core and replace with new one supplied with the replacement klystron.

g. Insert the spring and core into the cavity.

h. Insert the new klystron into the cavity by pushing straight until it stops. Rotate the klystron clockwise and push simultaneously until the tube suddenly moves forward and bottoms. It should also be noted that, when pushing the tube, a fair amount of force is required. If the klystron is pushed straight in and NOT on an angle, this force will not harm it.

i. Insert the spacer, Make sure spacer is flat against the spring.

j. Insert and screw on the knurled nut all the way by hand. (Lock down with spanner wrench).

k. Align the unit in accordance with the procedures outlined in paragraphs 4-18 through 4-30.

4-18. ADJUSTMENT AND CALIBRATION PROCEDURES. (See paragraph 4-31 for use of the Test Connector as an aid in making test measurements.)

4-19. Instrument adjustment and calibration procedures are given in paragraph 4-20 through 4-28. After performing any of the adjustment and calibration procedures given below, perform the minimum performance checks given in table 4-2. Connect power cord to ac source and switch POWER switch to the ON position.

WARNING

HIGH VOLTAGES ARE PRESENT AND PROPER SAFETY PRECAUTIONS MUST BE EXERCISED WHEN MAKING ANY ADJUSTMENTS.

4-20. -325 VOLT ADJUSTMENT. To adjust the -325 volt supply, set the instrument for CW operation and proceed as follows:

a. Rotate BEAM CURRENT ADJ A5A2R5 to midpoint.

b. Set digital multimeter to 20 VDC range. Connect pin 4 of the test connector A4TP to V-Ω of the multimeter and pin 2 to COMMON.

c. Adjust BEAM CURRENT ADJ A5A2R5 for an indication of 2.00V on the multimeter (see figure 4-13 for location of A5A2R5).

d. Set digital multimeter Fluke 8000A for 1200 volt dc range, connect lead to chassis, and + lead to pin 2 of connector A3A1J8.

e. Adjust the H.V. ADJ control A4R21 for -325 volts (see figure 4-12 for location of A4R21).

f. Glyptol-lock the potentiometer A4R21.

g. Disconnect the differential voltmeter.

4-21. -825 VOLT ADJUSTMENT. To adjust the -825 volt supply, set the instrument for CW and proceed as follows:

a. Set digital multimeter Fluke 8000A for 1200 volt dc range, connect COMMON lead to chassis, and the + lead to pin 3 of connector A3A1J5 and turn ΔF control fully clockwise.

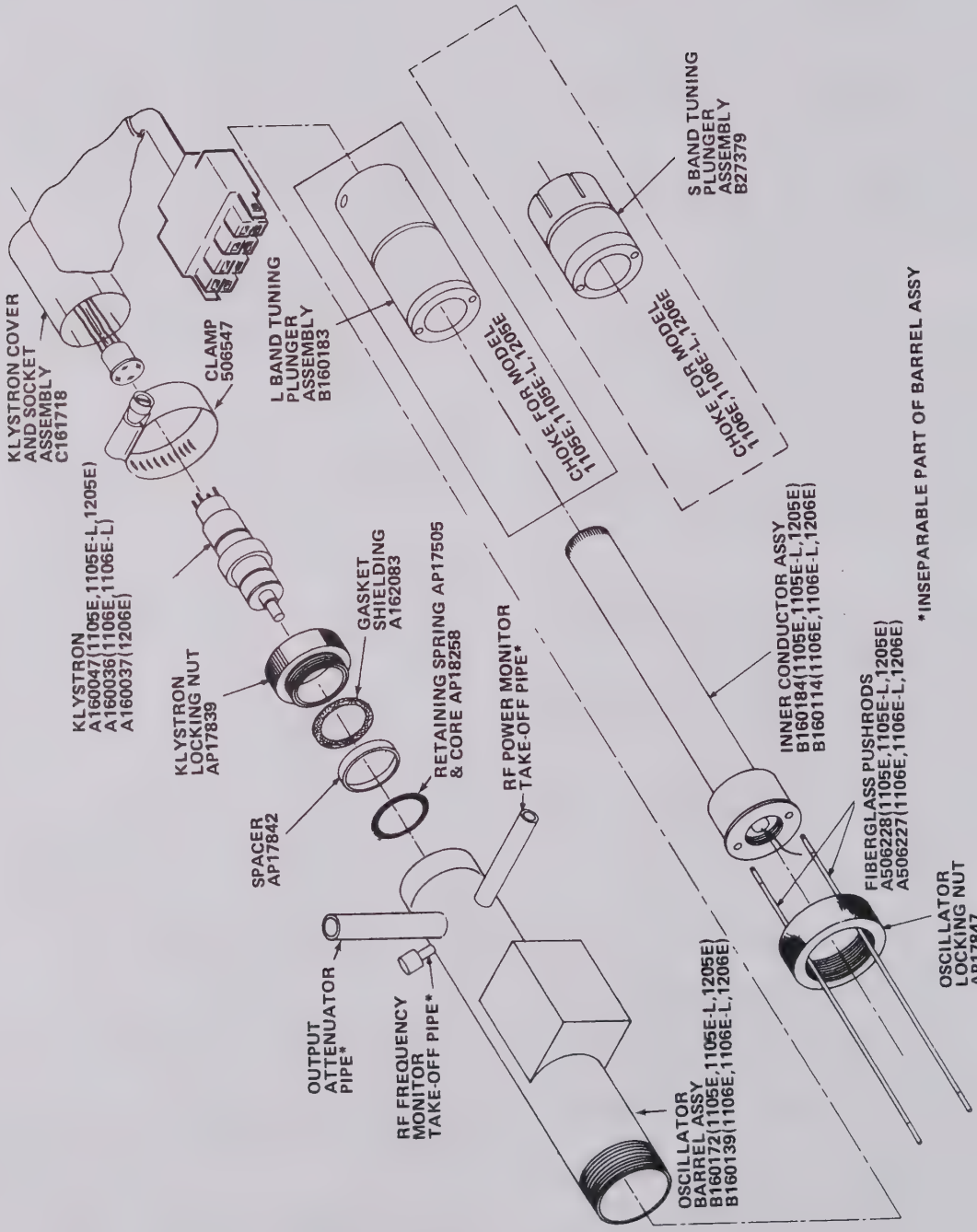

KLYSTRON COVER AND SOCKET ASSEMBLY C161718
CLAMP 506547
L BAND TUNING PLUNGER ASSEMBLY B160183
S BAND TUNING PLUNGER ASSEMBLY B27379
KLYSTRON A160047(1105E,1105E-L,1205E) A160036(1106E,1106E-L) A160037(1206E)
KLYSTRON LOCKING NUT AP17839
GASKET SHIELDING A162083
RETAINING SPRING AP17505 & CORE AP18258
RF POWER MONITOR TAKE-OFF PIPE*
CHOKE FOR 1105E,1105E-L,1205E
CHOKE FOR 1106E,1106E-L,1206E
SPACER AP17842
OUTPUT ATTENUATOR PIPE*
RF FREQUENCY MONITOR TAKE-OFF PIPE*
OSCILLATOR BARREL ASSY B160172(1105E,1105E-L,1205E) B160139(1106E,1106E-L,1206E)
INNER CONDUCTOR ASSY B160184(1105E,1105E-L,1205E) B160114(1106E,1106E-L,1206E)
FIBERGLASS PUSHRODS A506228(1105E,1105E-L,1205E) A506227(1106E,1106E-L,1206E)
*INSEPARABLE PART OF BARREL ASSY
OSCILLATOR LOCKING NUT AP17847

Figure 4-2. Klystron Cavity, Exploded View

b. Adjust the -825V ADJ control A3A1R42 for -825 volts (see figure 4-11 for location of A3A1R42).

c. Glyptol-lock potentiometer A3A1R42.

d. Disconnect the digital multimeter.

e. Return the ΔF control to the center "0."

4-22. BEAM CURRENT ADJUSTMENT. To adjust the beam current after adjusting the -325 and -825 volt supplies, set the instrument for CW operation and proceed as follows:

a. Set digital multimeter to the 20 VDC range. Connect pin 4 of the test connector A4TP to V-Ω of the multimeter and pin 2 to COMMON.

b. Adjust the BEAM CURRENT ADJ control A5A2R5 for 2.00V ±20% (1105E, 1105E-L, 1205E) or 3.50V ±20% (1106E,1106E-L,1206E) on the multimeter. See fig. 4-11 for location of A5A2R5.

c. Scan through the frequency band and readjust so that 1.60V (1105E, 1105E-L, 1205E) or 2.2 V (1106E, 1106E-L, 1206E) is minimum at any point.

d. Glyptol-lock BEAM CURRENT ADJ potentiometer A5A2R5.

e. Disconnect the multimeter with the unit operating.

4-23. FILAMENT VOLTAGE ADJUSTMENT. To adjust the filament voltage proceed as follows:

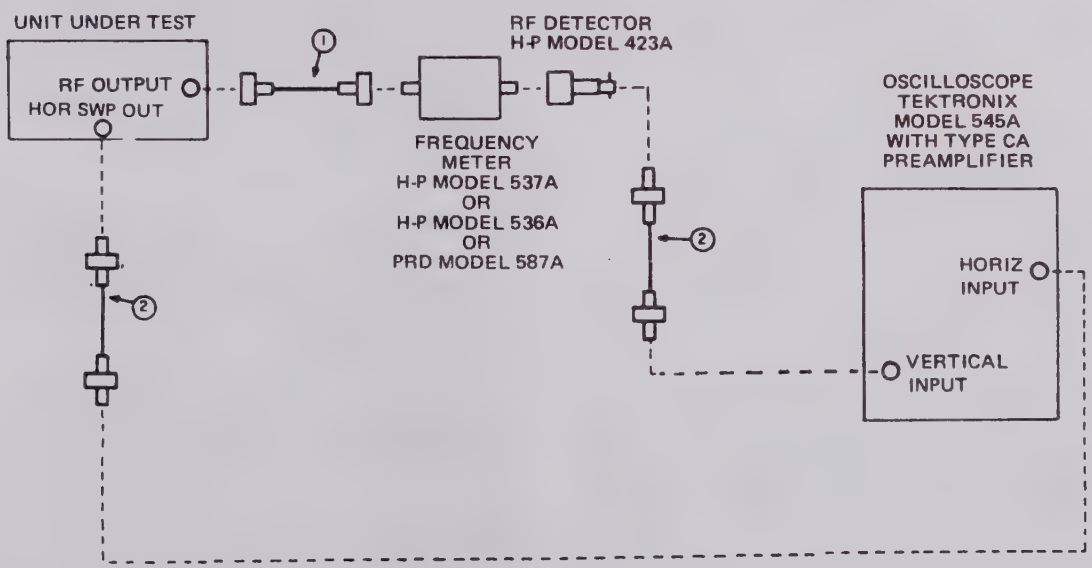
a. Connect the digital voltmeter to pin 2 of connector A3A1J3 and the COMMON lead to pin 3 of connector A3A1J3.

b. Adjust 6.3 ADJ control A3A1R1 for +6.3 volts (see figure 4-11 for location of A3A1R1).

4-24. INT FM DEV RANGE ADJUSTMENT. To adjust the range of INT FM DEV control, set instrument for CW mode of operation and proceed as follows:

a. Set MODULATION SELECTOR switch to INT FM ~.

b. Connect equipment as shown in figure 4-3.



(1) RF CABLE P/N B12551 SUPPLIED AS AN ACCESSORY
(2) VIDEO CABLE

Figure 4-3. Test Setup for Klystron Frequency and Repeller Tracking Adjustments

c. Adjust the INT FM DEV control fully counterclockwise.

d. Adjust HOR SWP PHASE control so that mode pattern of figure 4-5C is obtained.

e. Adjust INT FM DEV range adjustment A3A1R17 so that complete mode patterns can be observed of the respective model (see figure 4-11 for location of A3A1R17).

4-25. KLYSTRON FREQUENCY ALIGNMENT. Due to variations in klystron repeller voltage characteristics and other parameters, the tuning cam and repeller voltage adjustments must be made whenever the klystron is replaced or the performance of the instrument doesn't meet the minimum performance requirements of table 4-2. To align the klystron for frequency and repeller voltage tracking, proceed as follows:

Note

The voltage and current adjustments of paragraphs 4-20 through 4-24 must be performed before klystron alignment is begun.

a. Connect test equipment as shown in figure 4-3.

Note

If a component in the repeller voltage tracking circuitry has been replaced, or the glyptol locks of the tracking potentiometers have been broken, set all tracking potentiometers to their typical repeller voltage as indicated in figure 4-6 or 4-7. If only the klystron has been replaced, this preliminary rough setting is not required.

b. Set MODULATION SELECTOR switch to INT FM ~.

c. Apply power to instrument and test equipment and allow them to warm up for 15 minutes.

d. Rotate frequency control knob to position the cam follower at the fixed point on the tuning cam shown in figure 4-4.

Note

Set ΔF control at "0."

e. Check the FREQUENCY GHz readout. It should be about 1.52 GHz for Models 1105E/1105E-L and 1205E or 2.80 GHz for Models 1106E/1106E-L, and 1206E.

f. Adjust attenuator output level, INT FM DEV and HOR SWP PHASE controls and oscilloscope to obtain a stable display of the klystron mode pattern, similar to figure 4-5, pattern C.

g. Tune frequency meter to place dip due to frequency meter at peak of mode pattern as shown in figure 4-5, pattern D.

h. Frequency meter reading should be within ±0.1% of FREQUENCY GHz readout. If it is not, loosen the socket head screw in the cam follower yoke (figure 4-8) and adjust push rod yoke to bring frequency within tolerance. Retune frequency meter to check push rod yoke adjustment and then tighten socket head screw.

i. Rotate frequency control knob to position eccentric adjustment 4 (1105E/1105E-L/1205E) or 5 (1106E/1106E-L/1206E (figure 4-4) opposite cam follower. Tune frequency meter to check instrument frequency which should be within ±0.1% FREQUENCY GHz readout. If frequency is not within tolerance, loosen the screws on the top of the tuning cam for adjustments 4, 5, and 6 for Models 1105E, 1105E-L, and 1205E; adjustments 5 through 7 for Models 1106E, 1106E-L, and 1206E.

Note

If adjustment 4 or 5 requires change, loosen all of the screws involved. If only one of the other adjustments requires change loosen that screw only and take care that the cam is not distorted.

j. Rotate frequency control knob to position next eccentric adjustment opposite cam follower. Repeat the procedure of step i.

k. Repeat step j for other adjustments to top of frequency range.

l. For Models 1106E, 1106E-L, and 1206E recheck frequencies for adjustments 5, 6, and 7.

m. Tighten adjustment screws after the adjustments are within tolerance, making sure that the adjustments are not changed thereby, then repeat step l.

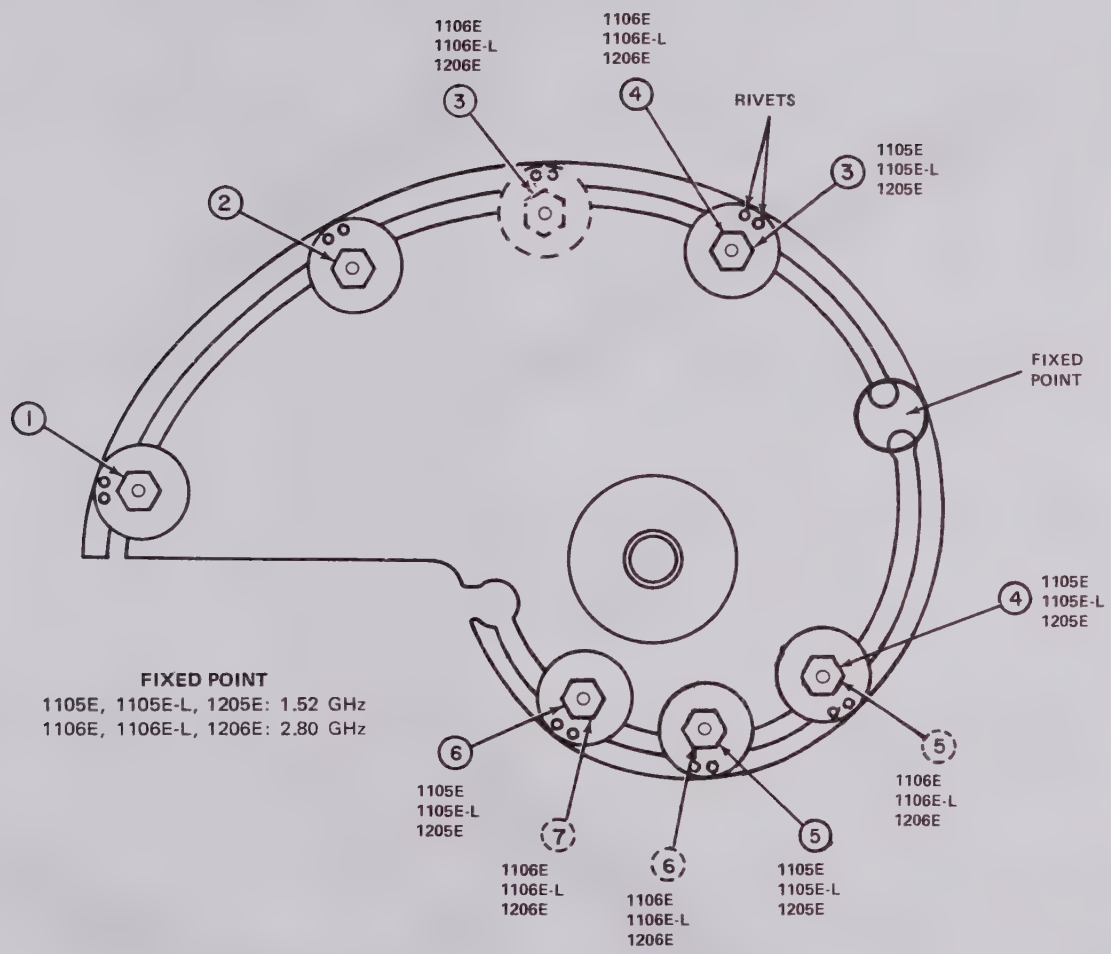


Figure 4-4. Tuning Cam Adjustments

n. Rotate frequency control knob to position adjustment 4 (1106E/1106E-L/1206E), 3 (1105E/1105E-L/1205E), opposite cam follower. Check instrument frequency which should be within ± 0.1% FREQUENCY GHz readout. If frequency is not within tolerance, loosen the screws on the top of the tuning cam for adjustments 4, 3, 2, and 1 (Models 1106E, 1106E-L, and 1206E) or adjustments 3, 2, and 1 (Models 1105E, 1105E-L, and 1205E).

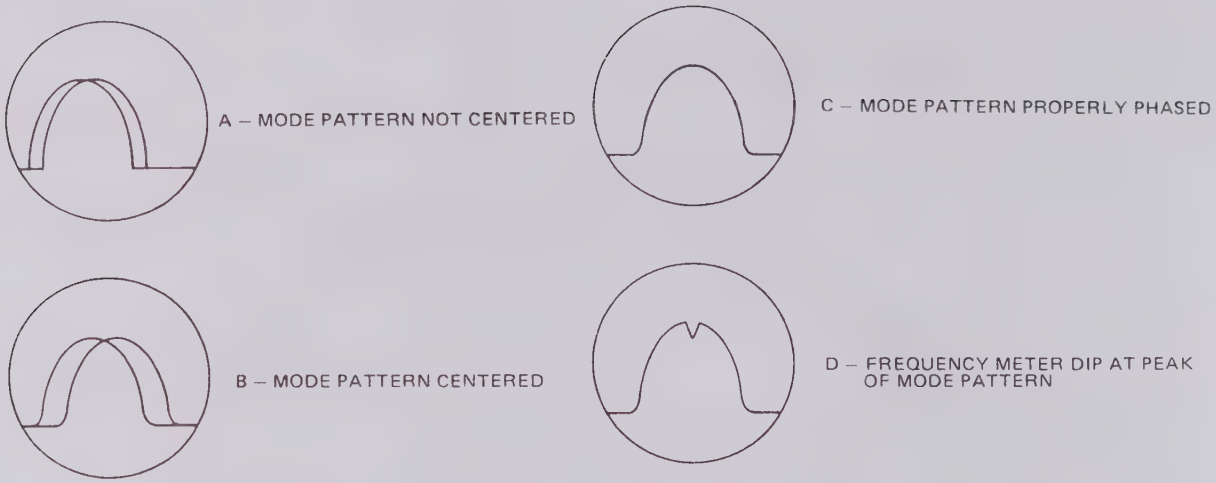
o. Set adjustment 4 (1106E/1106E-L/1106E), 3 (1105E/1105E-L/1205E) to bring instrument frequency within tolerance, then tighten screw on top of cam.

p. Repeat steps n and o for adjustments 3, 2, and 1.

q. After making adjustment 1, recheck frequencies for adjustments 1, 2, 3, and on Models 1106E, 1106E-L and 1206E, only, 4. If necessary repeat steps n and p.

r. Leave test setup operating for repeller tracking adjustments.

4-26. REPELLER VOLTAGE TRACKING ADJUSTMENTS. After completing the klystron frequency alignment of paragraph 4-25 proceed with the repeller voltage tracking adjustments given below. If the proper mode display is obtained prior to adjustment, omit the adjustment. The typical repeller voltage vs. frequency characteristics for Models 1105E, 1105E-L, and 1205E are shown


A – MODE PATTERN NOT CENTERED
C – MODE PATTERN PROPERLY PHASED
B – MODE PATTERN CENTERED
D – FREQUENCY METER DIP AT PEAK OF MODE PATTERN

Note: Patterns shown are for positive detected voltage RF Detector. For negative detector, the patterns will be in the downward direction.

Figure 4-5. Mode Patterns

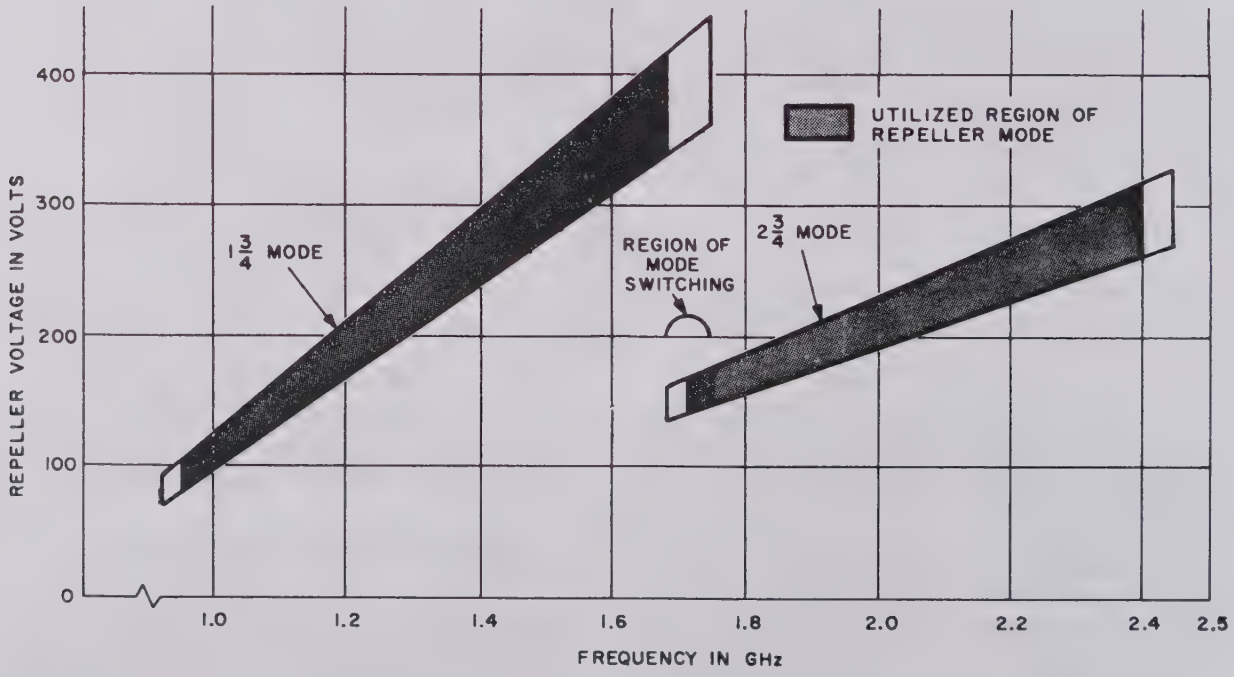


Figure 4-6. Typical Repeller Voltage Vs. Frequency Characteristics, Models 1105E, 1105E-L, and 1205E

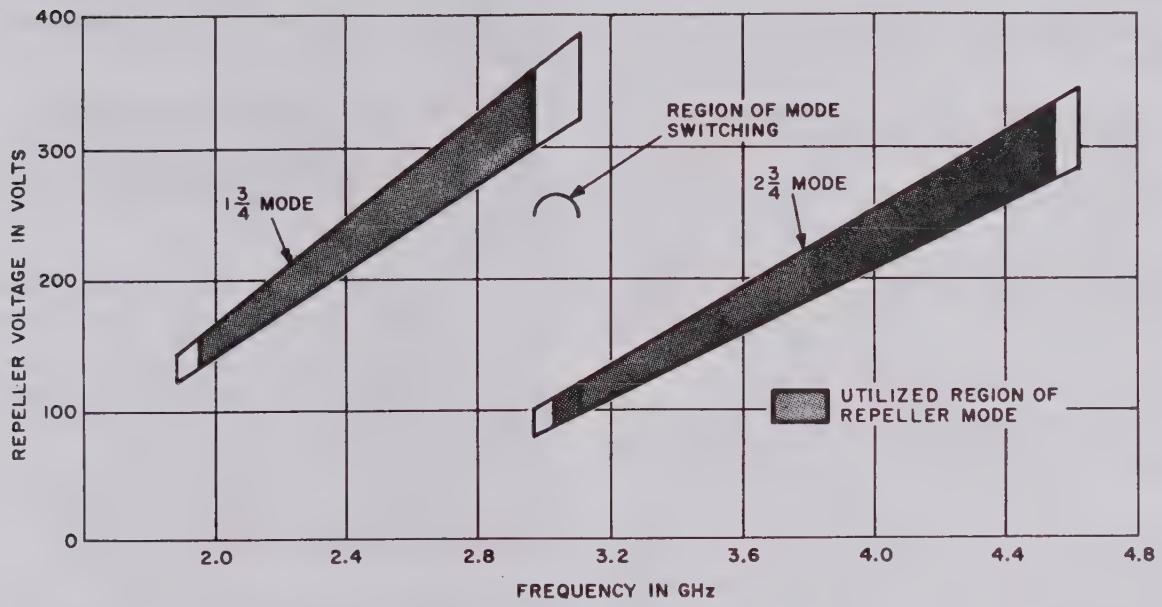


Figure 4-7. Typical Repeller Voltage Vs. Frequency Characteristics, Models 1106E, 1106E-L, and 1206E

in Figure 4-6 and the typical repeller voltage vs. frequency characteristics for Models 1106E, 1106E-L, and 1206E are shown in figure 4-7.

a. Rotate the frequency control knob to the low end of the frequency range of the instrument — 0.80 GHz for Models 1105E, 1105E-L and 1205E; 1.80 GHz for Models 1106E, 1106E-L, and 1206E.

b. Set MODULATION SELECTOR switch to INT FM ~ and rotate HOR SWP PHASE control to obtain a single track of the mode pattern, as in C of figure 4-5.

c. If the Mode Pattern appears as in A of figure 4-5, the repeller voltage is not correct for the klystron frequency. Adjust LOW potentiometer A6R1 to center the mode pattern, as in B of figure 4-5.

d. Rotate the frequency control knob to the point jsut before the mode switch A7S1 operates. If necessary, adjust the LOW MODE potentiometer A6R2 to center the mode pattern.

e. Rotate the frequency control knob to the point just after the mode switch A7S1 operates. If necessary adjust HIGH MODE potentiometer A6R3 to center the mode pattern.

f. Rotate the frequency control knob to the high end of the frequency range of the instrument (Models 1105E, 1105E-L, and 1205E — 2.40 GHz; Models 1106E, 1106E-L, and 1206E — 4.60 GHz). If necessary, adjust HIGH potentiometer A6R4 to center the mode pattern.

g. Rotate the frequency control knob to cover the complete frequency range of the instrument. The mode pattern displayed on the oscilloscope should be continuous, should remain centered, and should not exhibit a loss of power at any point in the frequency range. However, there should be an abrupt change in power level at the mode switching point.

h. It may be necessary to fine adjust the tracking potentiometers A6R1 through A6R4 for minimum pulse jitter. To adjust to minimum pulse jitter, use test setup F of figure 4-1. Adjust the external modulation source for 0.5 μsec pulse width and scan through the frequency band. If at any frequency point (band), the pulse jitter exceeds 0.2 μsec, readjust the tracking potentiometer associated with that frequency. For example, if pulse jitter at 1.8 GHz is observed in Models 1105E/1105E-L, 1205E, A6R3, the HIGH MODE potentiometer should be readjusted until the pulse jitter is minimum.

i. Glyptol-lock the shafts of all tracking potentiometers.

j. Leave test setup operating for power output and final checks.

4-27. MODELS 1105E-L AND 1106E-L PROBES INSERTION AND ALIGNMENT

a. PROBE INSERTION AND ALIGNMENT. The ATTENUATOR probe and the POWER SET/AUTO-LEVEL SET probe must be properly inserted and aligned before adjusting the leveling circuits. If the probes have not been removed and conform to the requirements of step b (paragraph 4-14), proceed to paragraph 4-28. If one or both probes must be reinserted, proceed as follows:

b. POWER SET/AUTO-LEVEL SET probe insertion: Set POWER SET/AUTO-LEVEL SET control fully CW.

c. Insert probe so that scribe lines on pipe and probe line up with the probe ground facing to the rear of the unit for the Model 1106E-L. The probe is pushed in gently until it butts up against the inner conductor. Tighten the two screws on the collar, fastening the probe in place. For Model 1105E-L, orientation of the probe is not necessary.

d. Insert the attenuator probe in the same manner except that the ATTENUATOR control is first turned fully CW.

e. Check tracking of probes: Feed output of each probe to a power meter. At 800 MHz (1105E-L) or 1.8 GHz (1106E-L), set probes up for equal output (about −5 dBm). Increase frequency to 2.4 GHz (1105E-L) or 4.6 GHz (1106E-L), watching the tracking of the power meters. They should track within 0.5 dB for the 1105E-L and 0.8 dB for the 1006E-L.

f. If they do not track, slightly alter the position of the ATTENUATOR probe by rotating it slightly around the matched scribe lines and then retesting.

4-28. LEVEL/UNLEVELED OUTPUT ACCURACY ADJUSTMENTS. After the probes have been inserted with proper tracking, the following steps are followed for completed alignment.

a. Place POWER switch to ON position.

b. Place AUTO-LEVEL ON switch to off position.

c. Remove cable connector P7 of cable assembly W26 from Level Detector Z1.

d. Connect cable connector P7 to the input jack of a microwave power meter.

e. Set MODULATION SELECTOR switch to CW.

f. Tune the frequency control for a readout of 0.80 GHz on the FREQUENCY GHz dial of Model 1105E-L or 1.80 GHz on Model 1106E-L.

g. Set the POWER SET/AUTO-LEVEL SET control for a reading of −10 dBm on the microwave power meter.

h. Loosen the Allen screws in the knob of the POWER SET/AUTO-LEVEL control.

i. Adjust the knob of the POWER SET/AUTO-LEVEL SET control so that the red line on the knob lines up with the red line on the instrument front panel.

j. Tighten the Allen screws on the knob of the POWER SET/AUTO-LEVEL set control.

k. Recheck the reading of −10 dBm when the knob is reset clockwise to align the red scribe lines.

l. Connect another microwave power meter to the RF OUTPUT jack.

m. At 800 MHz (1105E-L) or 1.8 GHz (1106E-L), position the POWER SET and ATTENUATOR probes so that both power meters read −10 dBm.

n. Tune the frequency control over the entire frequency range of the instrument, checking that the microwave power meters at the RF OUTPUT jack and at connector P7 track together within 1.0 dB over the frequency range of the instrument. Poor tracking may be caused by improper orientation of the power set probe during the alignment procedure in paragraph 4-27.

o. Disconnect connector P7 from the microwave power meter and reconnect it to connector J7 on Level Detector Z1.

p. With the frequency at 800 MHz (1105E-L) or 1.80 (1106E-L), set the MODULATION SELECTOR switch to RF OFF and the AUTO LEVEL switch to ON.

q. Adjust zero A11R9 to zero set the power monitor meter A8M1.

r. 1) Set MODULATION SELECTOR switch to CW and turn the AUTO-LEVEL control A11R14 fully clockwise.

2) Set attenuator control for −1 dBm (1105E-L) or −1.5 dBm (1106E-L) on the power meter. Rotate the AUTO-LEVEL control so that the power level is decreased to −2 dBm on the power meter.

3) Adjust A3A1R31 (figure 4-11) so that the meter reads CAL.

s. Tune the frequency from the lowest frequency to the point just below the mode switch (this should be approximately 1.7 GHz for Model 1105E-L or 3.06 for Model 1106E-L). Note the variation in the leveled output on the power meter. This represents the variation in the 1¾ or low mode.

t. Adjust A11R22, the FLATNESS control for optimum flatness in step s.

u. Tune the frequency just above the mode switch to approximately 1.8 GHz for Model 1105E-L or 3.10 GHz for Model 1106E-L. Then tune to the highest frequency in the band and note the leveled output variation on the power meter. This represents the variation in the 2¾ or high mode.

v. Adjust A11R23 MODE OVERLAP so that the output variations of the two modes overlap. The adjustment is done in the higher mode.

w. Recheck the leveled output by turning the frequency dial through the complete range and observing the output level. It should be within ±0.75 dB for Model 1105E-L and within ±1.0 dB for Model 1106E-L.

x. LEVELED ATTENUATOR DIAL ALIGNMENT.

1) Set frequency to 1.5 GHz (1105E-L) or 3.0 GHz (1106E-L).

2) With the generator set up for leveled operation, set the ATTENUATOR dial to −15 dBm and note the output level on the power meter.

3) If it is at −15 dBm ±1.0 dB, proceed to table 4-2, step 4, and test according to directions given. If the results meet the specifications, the alignment is complete.

4) If the results are not within specifications, note the points where they are out. The dial is then adjusted for a compromise between the high and low points so that they will fall within the specifications.

5) This is done by setting the power output to the desired level on the power meter. The two spline screws are opened to the gear hub of the attenuator dial. This unlinks the dial from the attenuator shaft.

6) Turn the attenuator knob to the desired dial reading. The power output should not change when rotating the dial at this time.

7) Tighten the two spline screws and recheck levels. They should fall within specifications. It might be necessary to make this adjustment more than once to reach the desired results. The results should be confirmed by testing to table 4-2, step 4.

y. UNLEVELED ATTENUALTOR DIAL ALIGNMENT.

1) Set frequency to 1.5 GHz (1105E-L) or 3.0 GHz (1106E-L).

2) Turn POWER SET control fully counterclockwise.

3) Switch AUTO LEVEL ON control to off position.

4) Adjust ATTENUATOR control for −15 dBm output.

5) Adjust POWER SET/AUTO-LEVEL SET control to place reference line on the cursor on −15 dBm of the attenuator dial.

6) Adjust A11R12 LEVELED-UNLEVELED BALANCE for an indication of CAL on power monitor meter A8M1.

7) Repeat step x, 3).

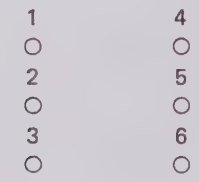
8) If the results are not within specifications, note the points where they are out. Adjust A11R12 LEVELED-UNLEVELED BALANCE ADJUSTMENT for a compromise between the high and low points so that they will fall within specifications.

z. Disconnect the microwave power meter from the RF OUTPUT connector on the front panel.

4-29. POWER OUTPUT CHECK. To check the power output of the instrument perform steps 1, 3A or 3B and 4 of table 4-2.

4-30. FINAL CHECK. To check the overall performance of the instrument, perform steps 3 and 6 through 9 of table 4-2. Replace top and bottom dust covers.

4-31. ACCESSORY TEST CONNECTOR. The Test Connector, A713772, supplied as part of the accessory kit, is used to assemble a test cable to aid in evaluation of the performance of the signal generator and implement voltage adjustments. The cable may have a length of up to four feet without affecting performance. Under normal operating conditions, voltages should be below +40 volts. A failure, however, in the High Voltage Box A5 could bring this level up to several hundred volts. Caution should, therefore, be used when locating the end of the cable and when making measurements. Viewing from the top of the connector, the pin numbers will be as follows:



The following voltage table indicates normal operation, when the MODULATION SELECTOR switch in the CW position and the voltage is at 115 vac.

	Pin Nos.	Indication	Tol.
Klystron Beam Current			
1105E,1105E-L,1205E:	4(+) to 2	2.0 vdc	±10%**
1106E,1106E-L,1206E:	4(+) to 2	3.5 vdc	±10%
Low Voltage DC Power Supply Voltage	1(+) to 2	32 vdc	±10%
Low Voltage DC Power Supply Current	5(+) to 1	200 mvdc	±10%***
*Low Voltage Bias	6(+) to 2	12 vdc	±10%

*The bias voltage must be read during the first minute after turning on the set (klystron filament warmup interval before the high voltage is applied).

**This is equivalent to 20 ma going through A5A1R8.

***This is equivalent to 1.00 amp going through A4R1.

After checking the voltages listed in the above table, monitor the klystron beam current (pins 4 and 2). With the MODULATION SELECTOR switch in the CW position, the voltage should be between 2.0 and 2.2 volts. Push in RF OFF control and the voltages should drop to 0.4 volts. Push in INT SQ WAVE control and the voltage should increase to 1.0 to 1.2 volts approx.

Pin 3 controls the delay circuit, which allows the klystron filament to warm up before the application of the high voltage. During the first minute, the voltage at the pin will be approximately 800 millivolts. It will drop to 0 volts when the high voltage is activated. This is indicated when an RF signal is generated. The delay circuit may be overridden if pin 3 is shorted to ground. The RF signal will slowly build up as the filament is heated.

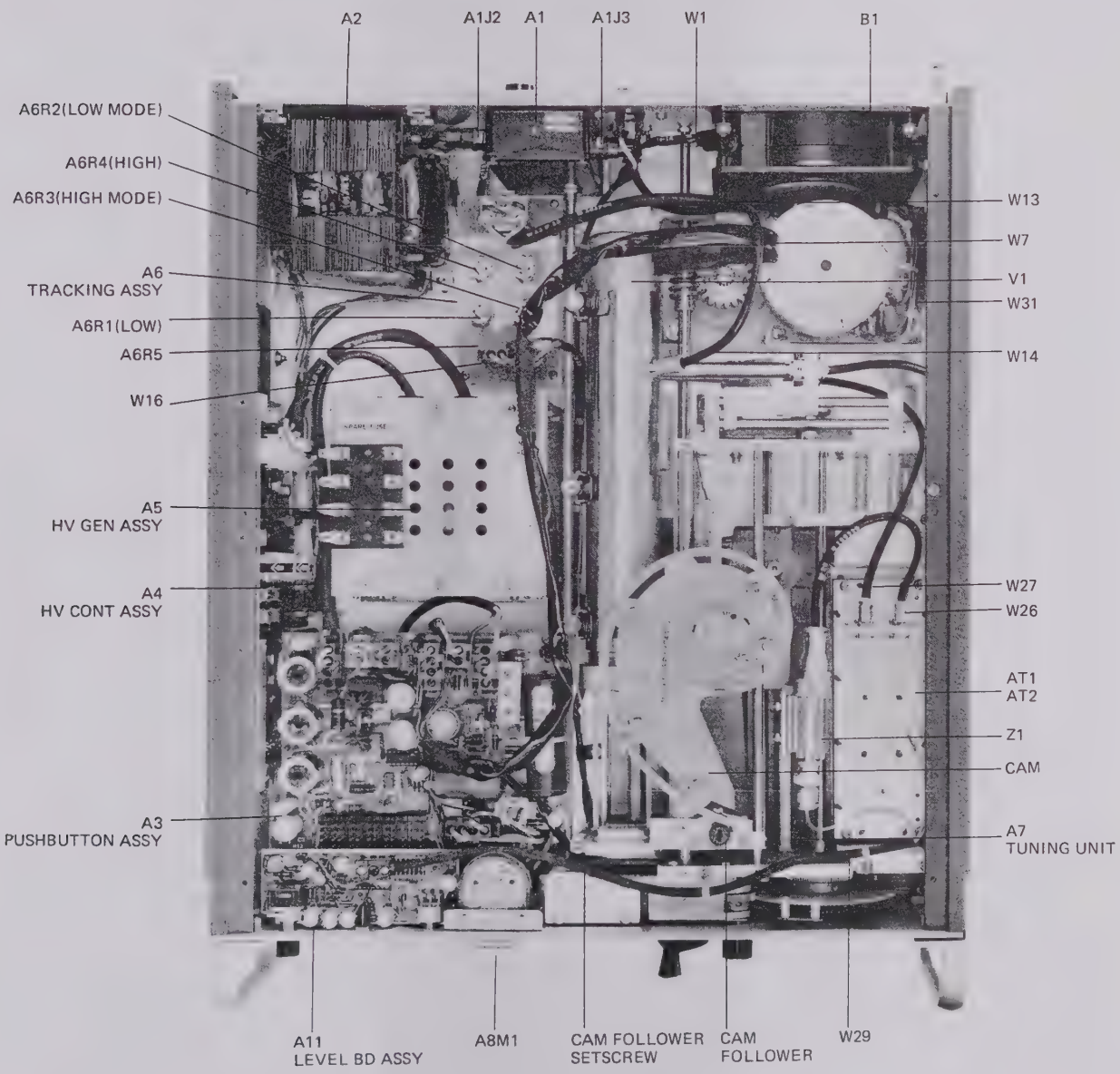


Figure 4-8. Typical Chassis, Top View

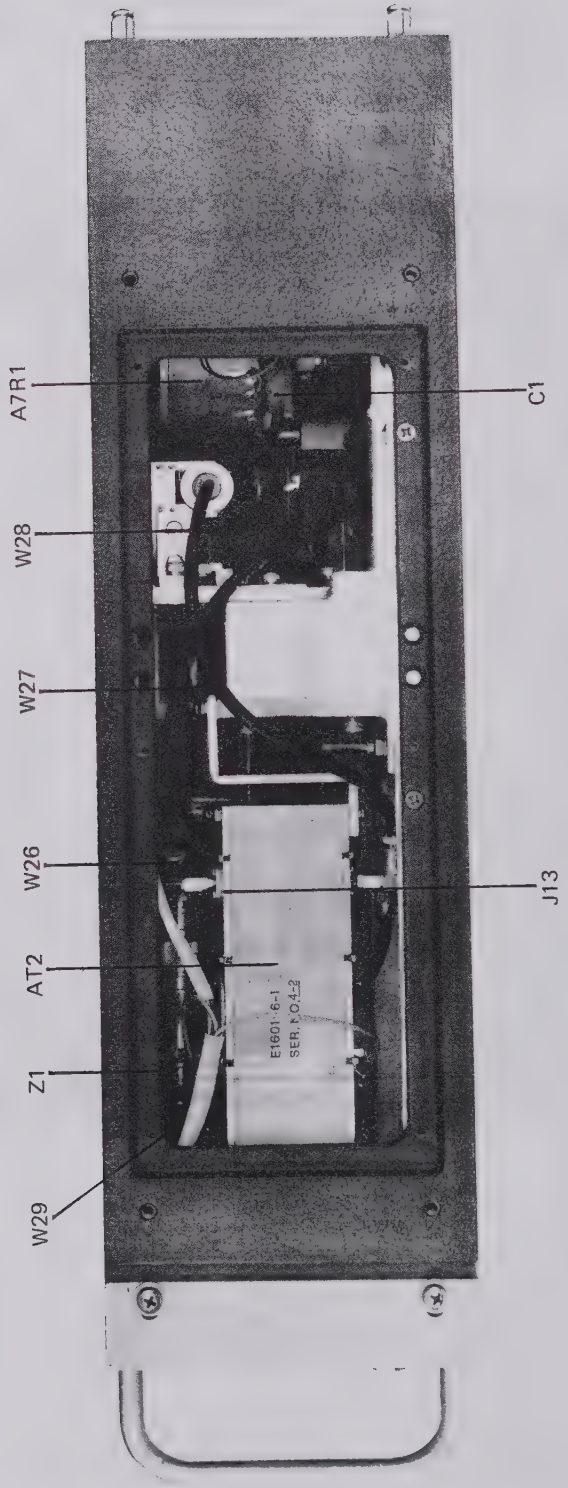


Figure 4-9. Typical Chassis, Side View

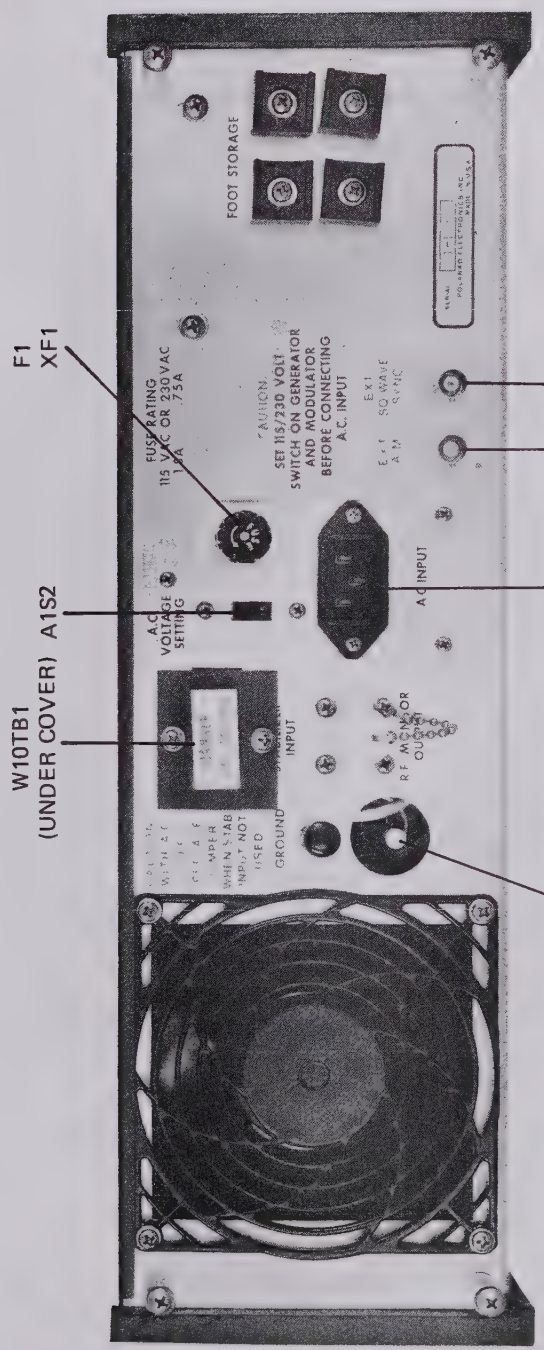


Figure 4-10. Typical Chassis, Rear View

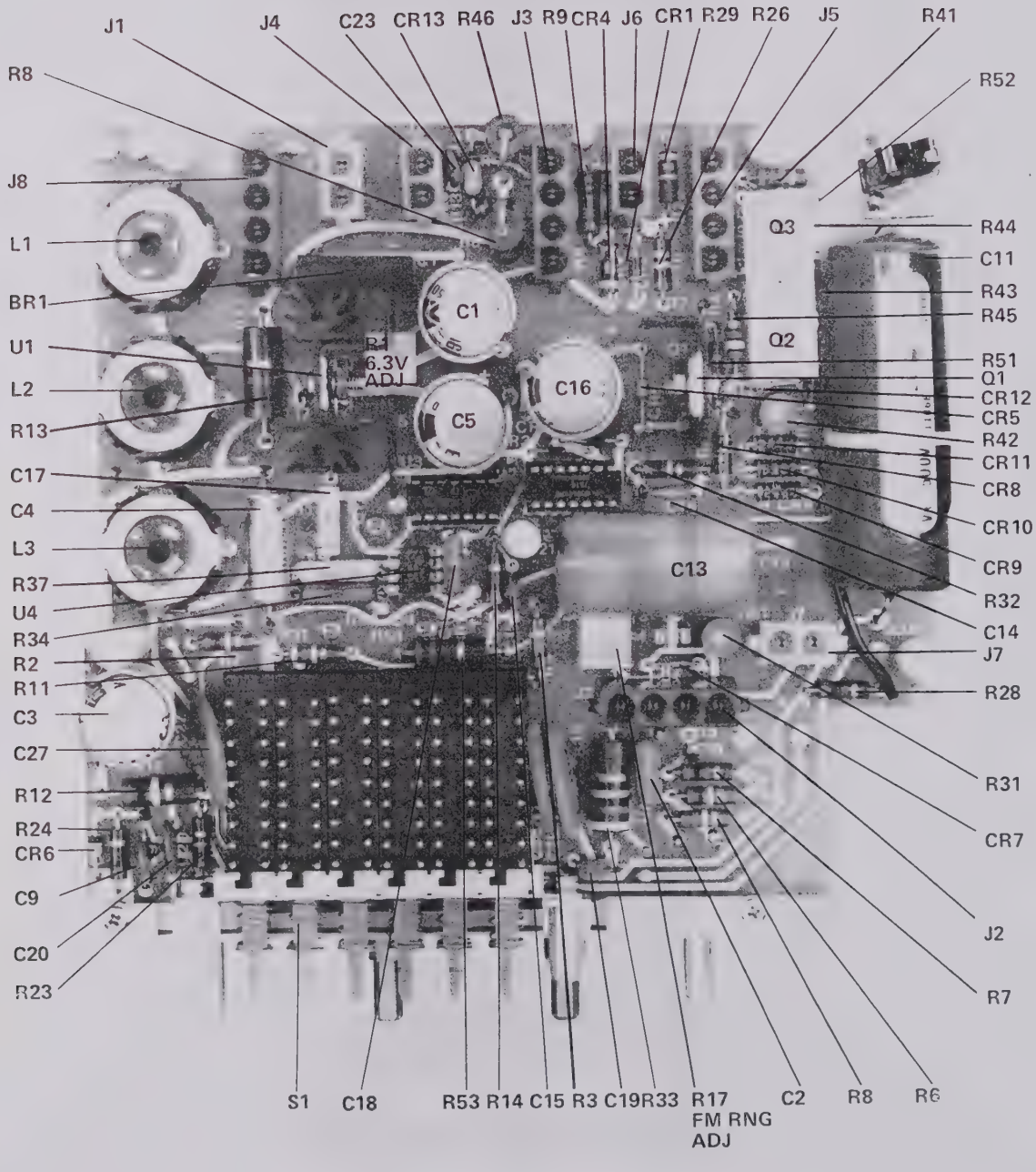


Figure 4-11. Pushbutton Board Assembly A3, Component Layout (Sheet 1 of 2)

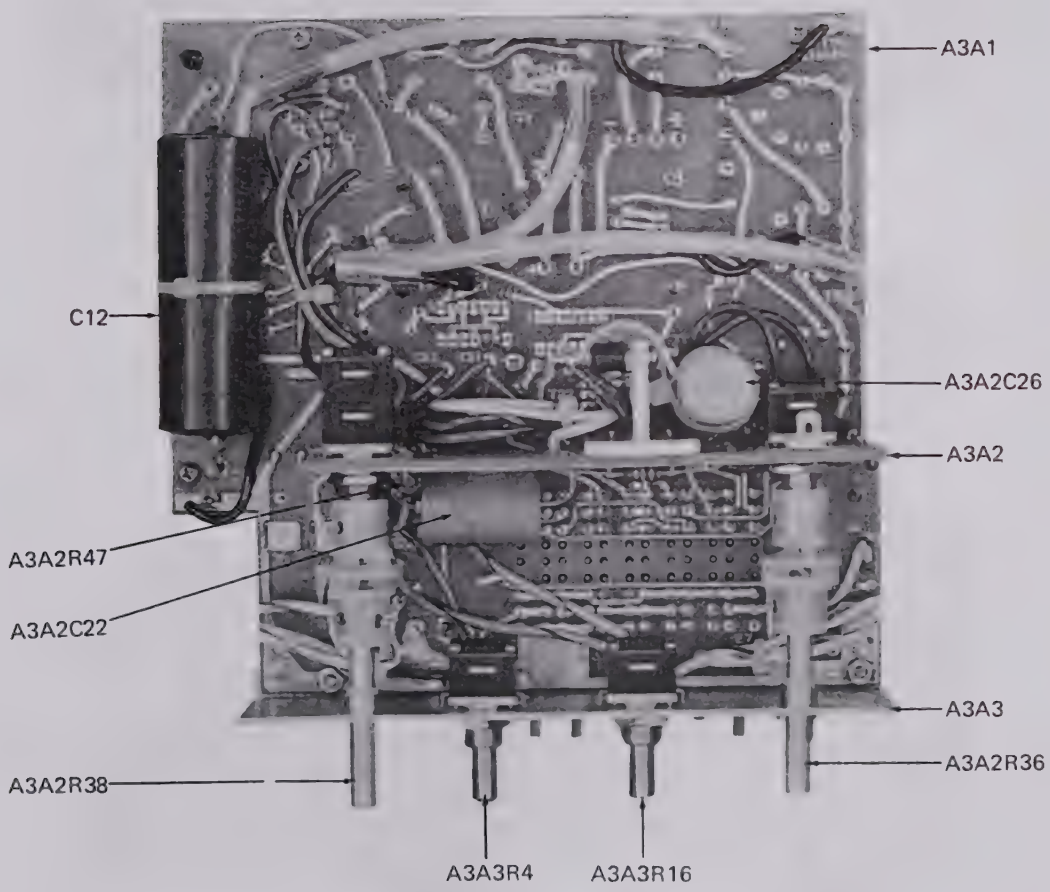
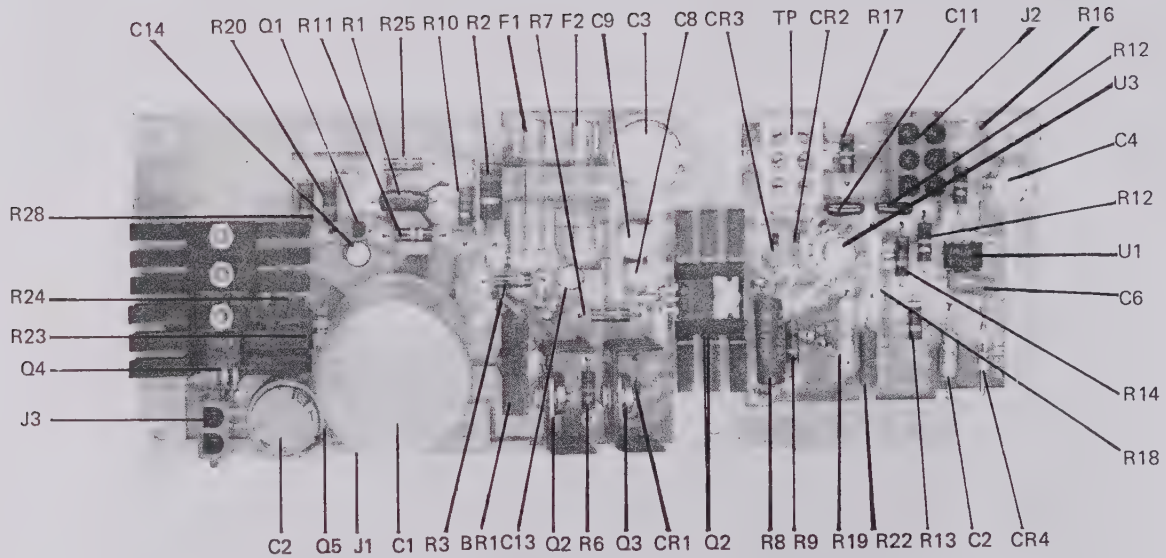


Figure 4-11. Pushbutton Board Assembly A3, Component Layout (Sheet 2 of 2)



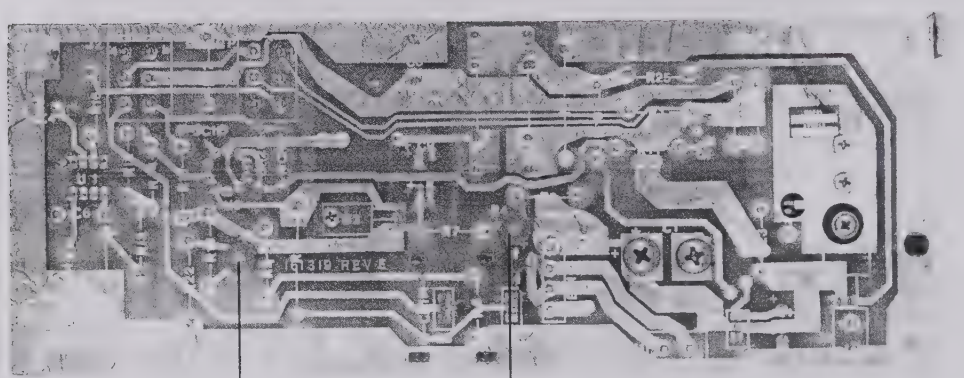


Figure 4-12. High Voltage Control Board Assembly A4, Component Layout

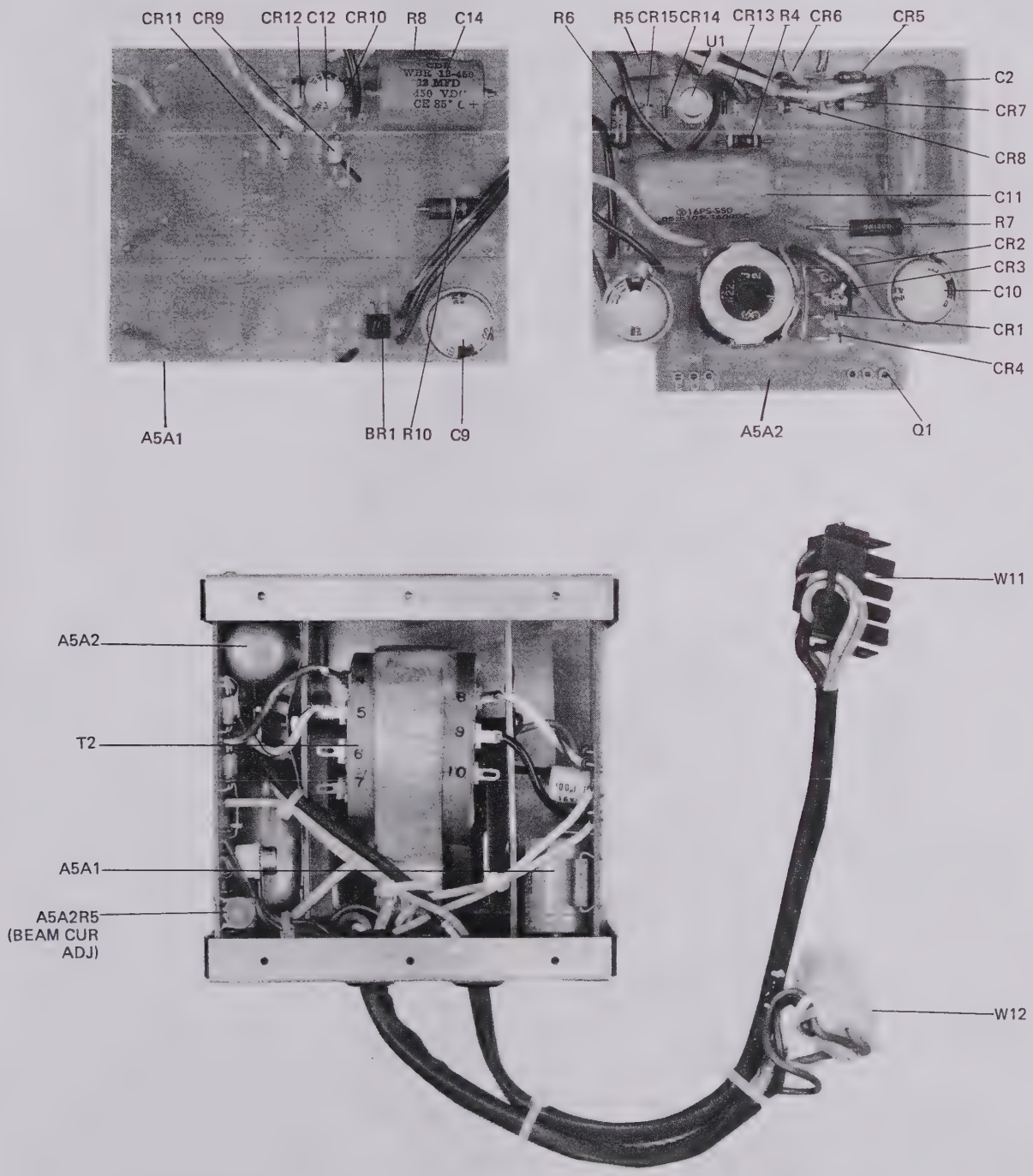


Figure 4-13. High Voltage Box Assemby A5, Component Layout

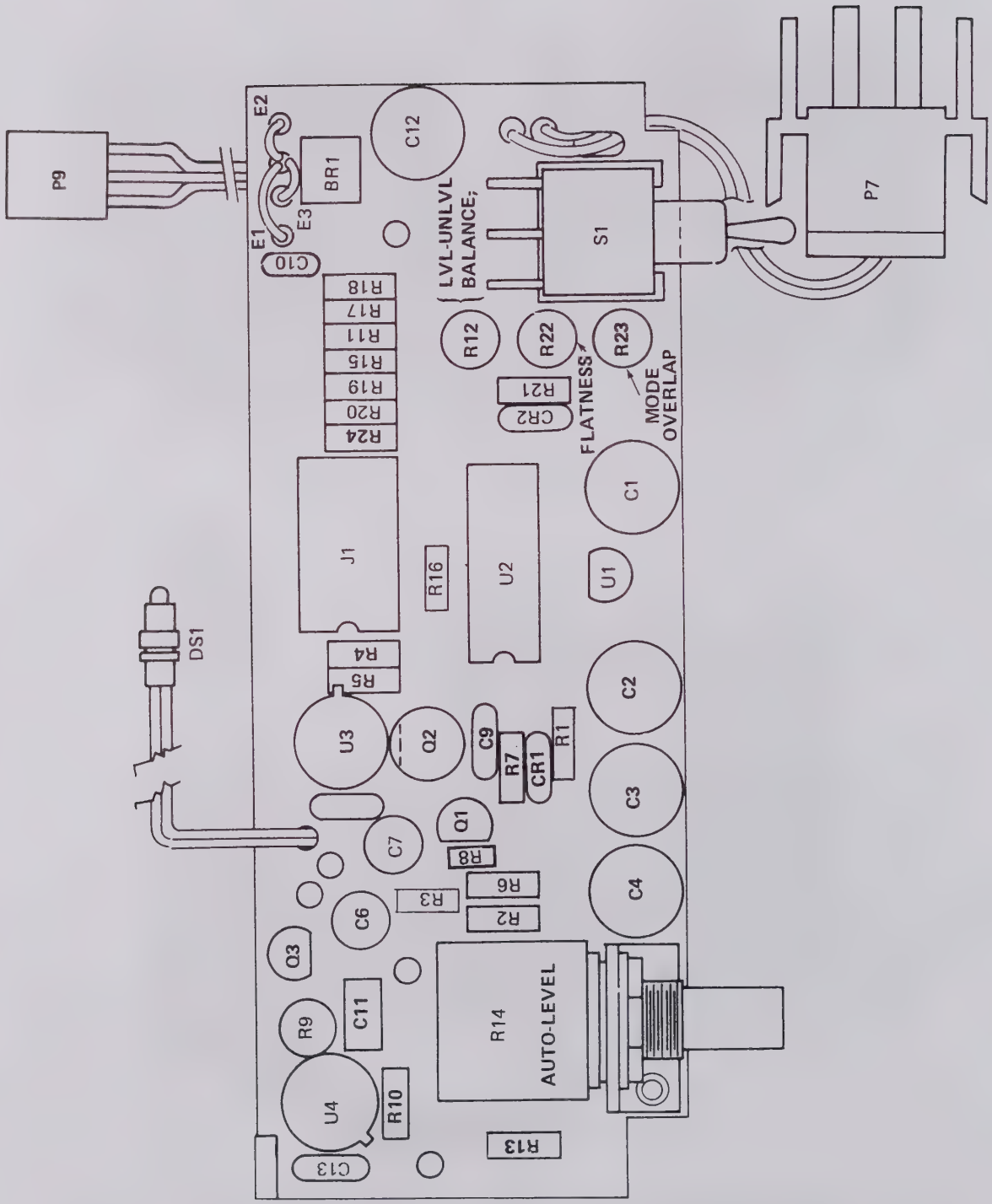


Figure 4-14. Level Stablizer Board A11, Component Layout

SECTION V

SCHEMATIC DIAGRAMS

5-1. GENERAL

5-2. This section contains the schematic diagrams (figures 5-1 through 5-7) and voltage and resistance measurements (table 5-1) that are essential aids in the maintenance of Models 1105E, 1105E-L, 1106E, 1106E-L, 1205E and 1206E. The diagrams are to be employed in conjunction with Section III to help the technician understand the operation of the unis. Both the diagrams and the voltage measurements are to be used in conjunction with Section IV to facilitate troubleshooting and maintenance operations.

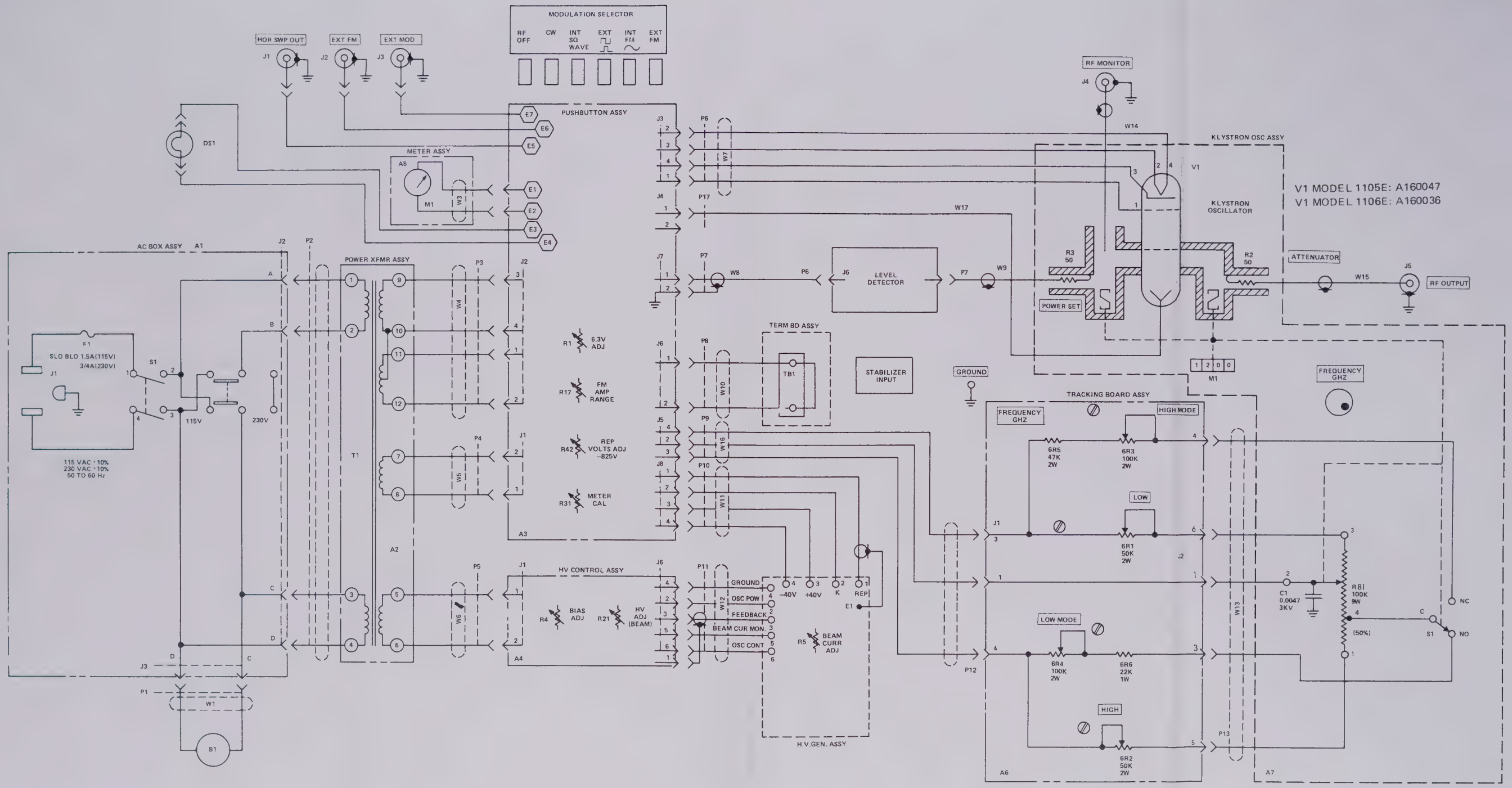
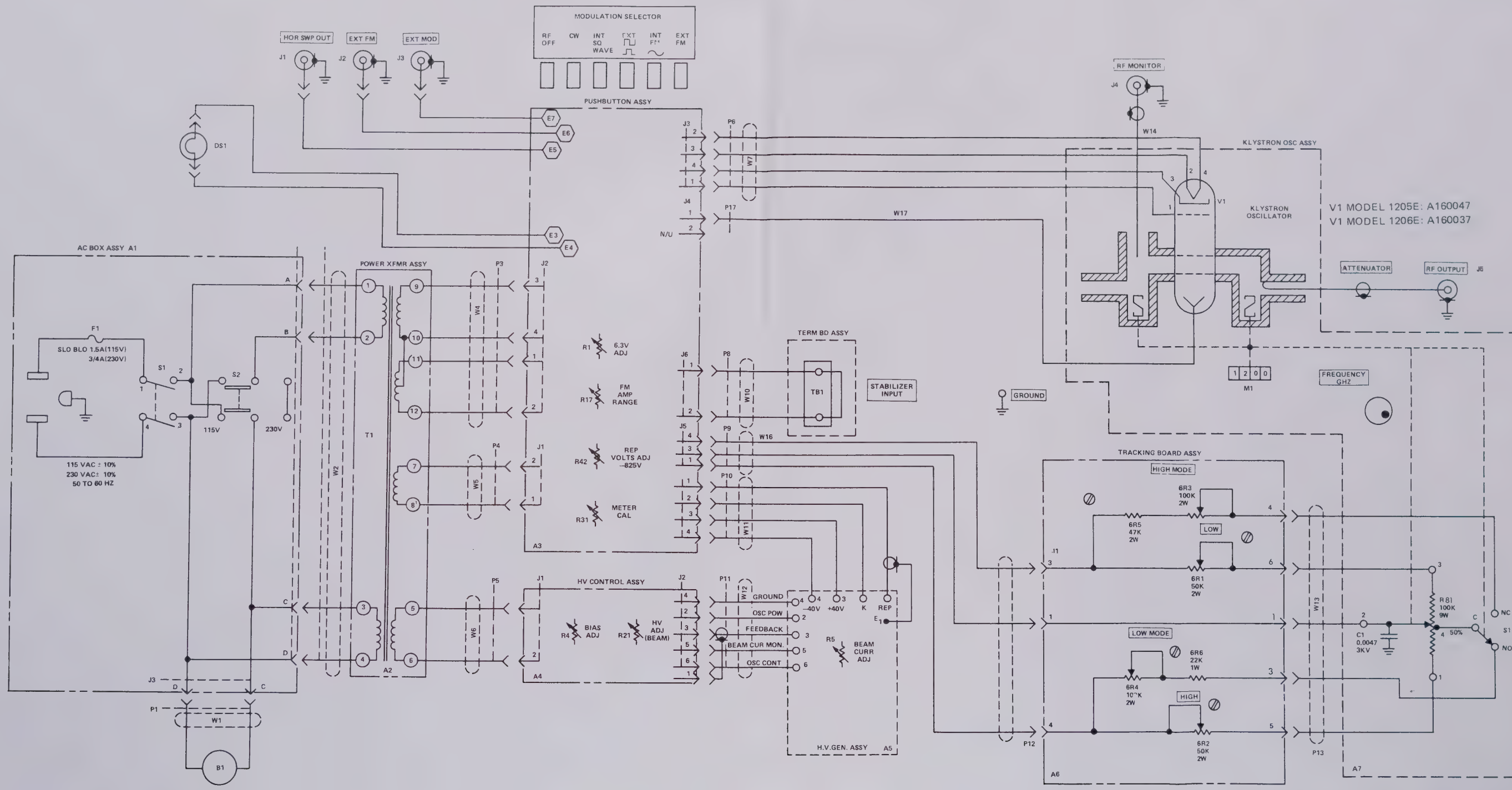


Figure 5-1. Models 1105E and 1106E Modular Microwave Signal Generator, Schematic Diagram

V1 MODEL 1105E-L: A160047
V1 MODEL 1106E-L: A160036

Figure 5-2. Models 1105E-L and 1106E-L Modular Microwave Signal Generator, Schematic Diagram



V1 MODEL 1205E: A160047
V1 MODEL 1206E: A160037

Figure 5-3. Models 1205E and 1206E Modular Microwave Signal Source, Schematic Diagram

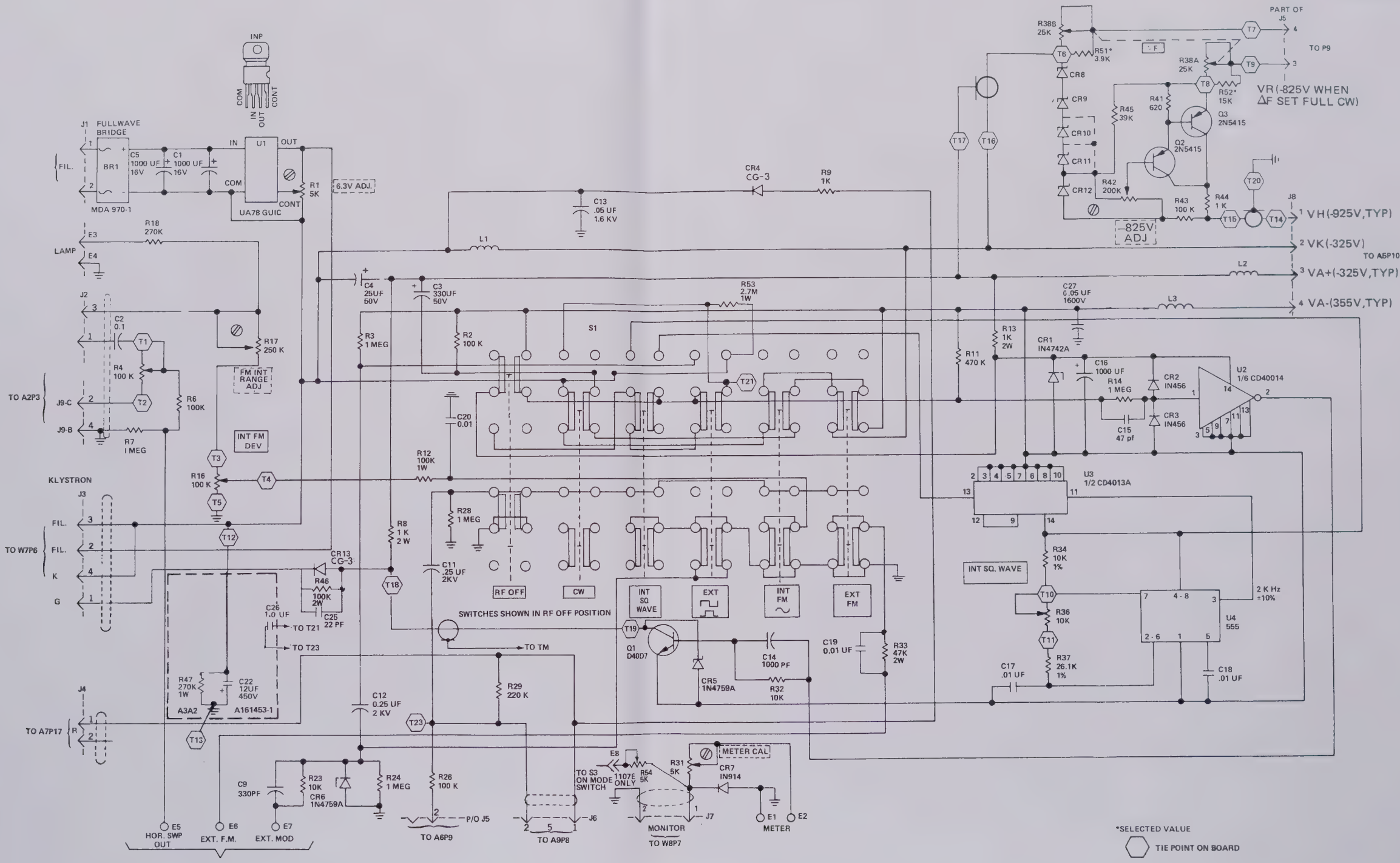


Figure 5-4. Pushbutton Board Assembly A3, Schematic Diagram

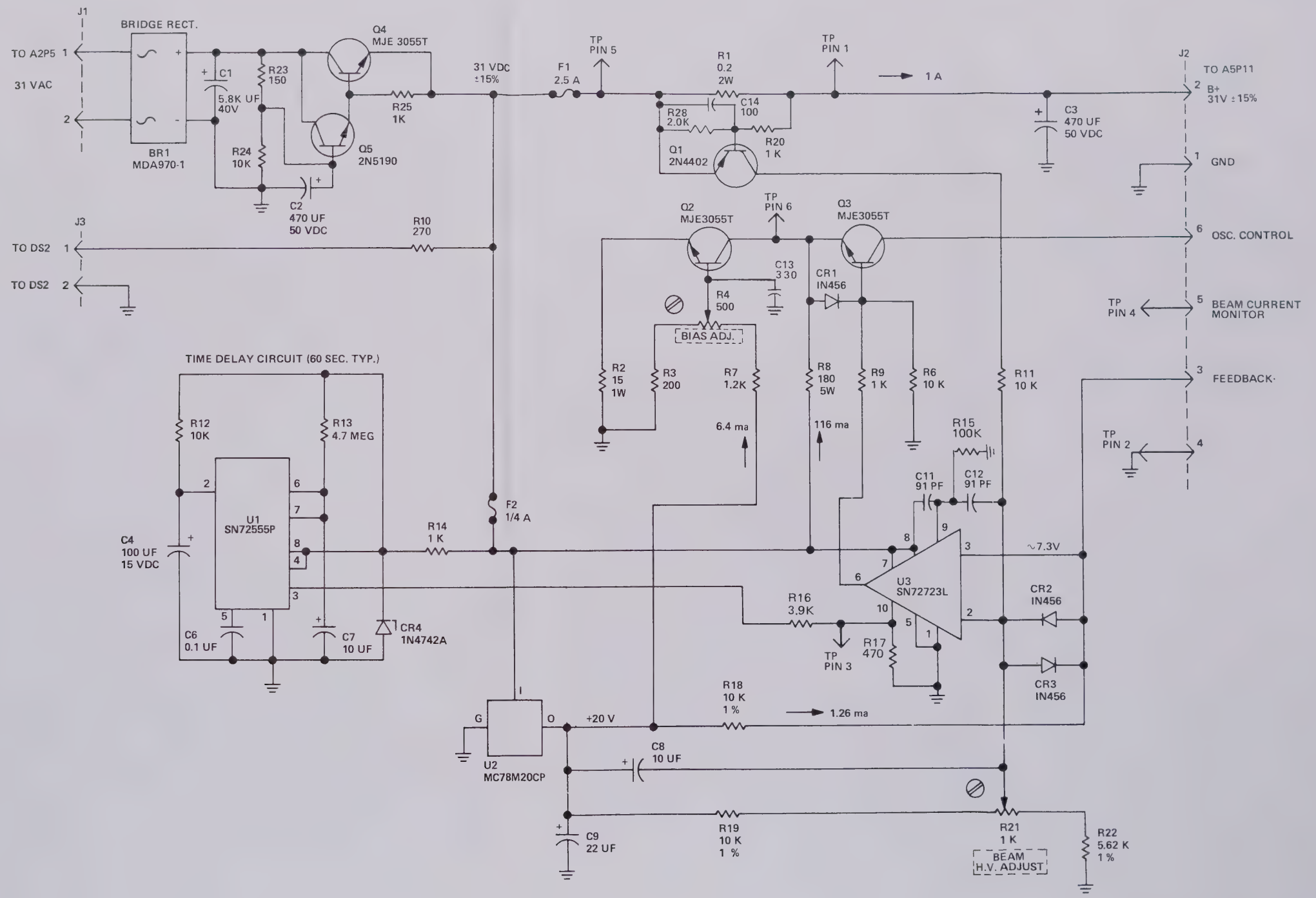


Figure 5-5. High Voltage Control Board Assembly A4, Schematic Diagram

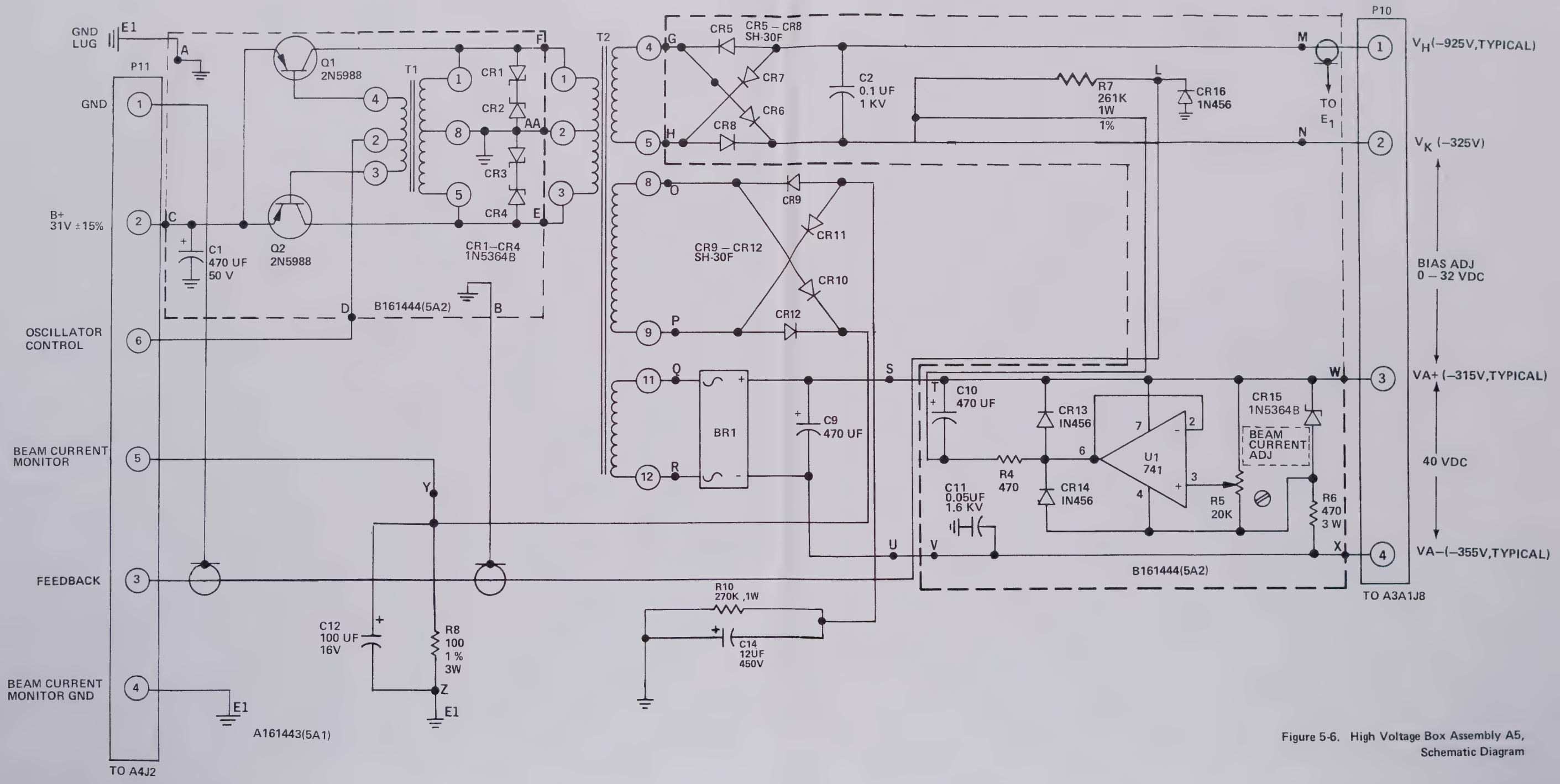


Figure 5-6. High Voltage Box Assembly A5, Schematic Diagram

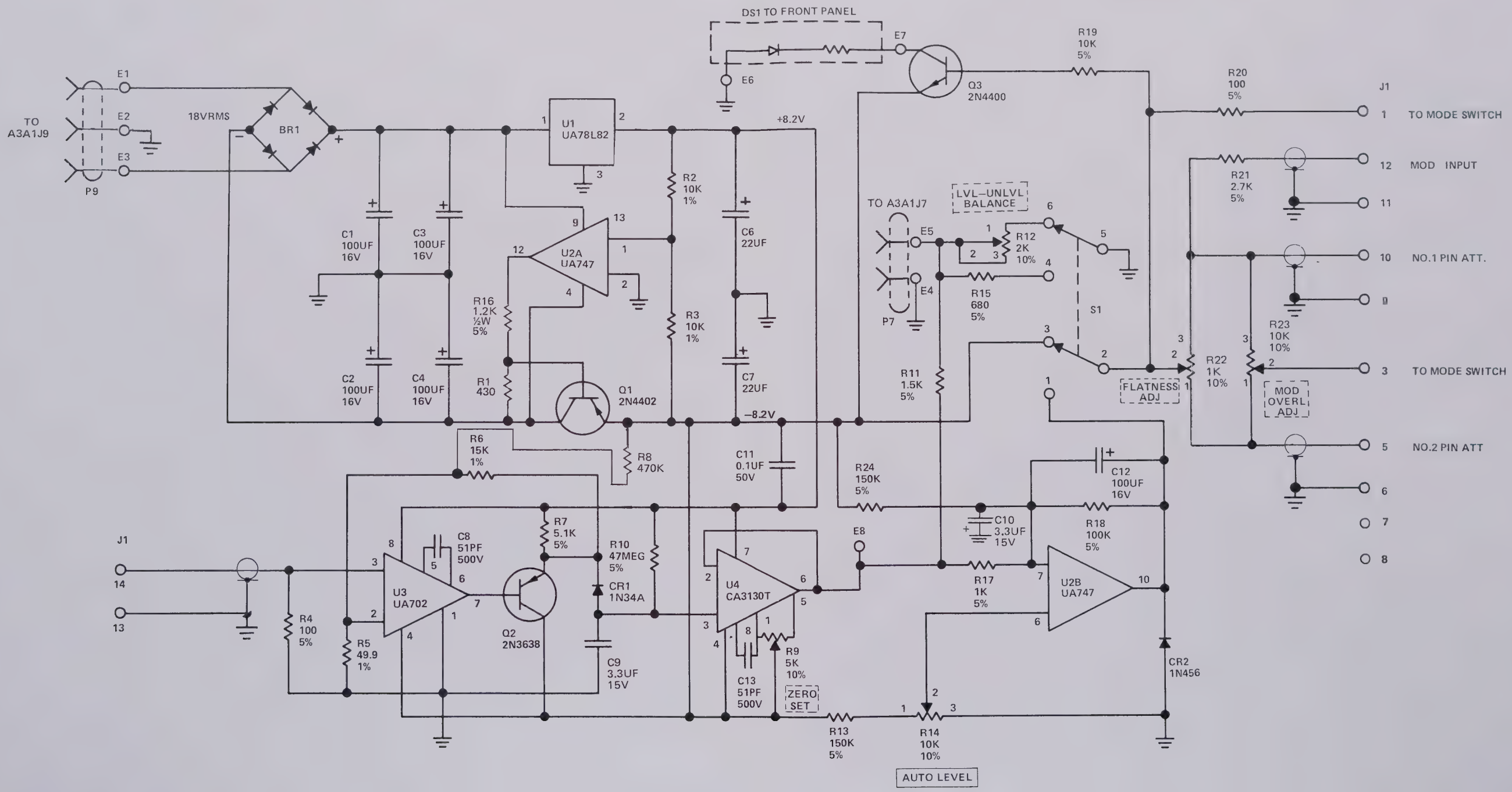


Figure 5-7. Level Stabilizer Board A11, Schematic Diagram

TABLE 5-1. VOLTAGE AND RESISTANCE MEASUREMENTS

SYMBOL	PART NO.	PIN NUMBERS 1 (E)	2 (B)	3 (C)	4	5	6	7	8	9	10	11	12	13	14	
PUSHBUTTON BOARD ASSEMBLY																
A3A1Q1	D40D7	-27.8	-27.8	+12.8												Volts
A3A1U2	CD40014P	3K	3.5K	0	3.5K	0	3.5K	0	3.5K	0	3.5K	0	3.5K	0	2K	Ohms
A3A1U3	CD4013AE	3.5K	0	0	0	0	0	0	0	3K	0	2.5K	3K	3K	2K	Ohms
A3A1U4	SN7255P	0	3K	2K	2K	5K	3K	2.5K	2K							Ohms
MODEL 1105E/1105E-L/1205E																
A3A1J1	350430-1	+9[a]	+6	0	0											Volts
A3A1J4	350786-1	-180[b]	N.C	—	—											Volts
A3A1J5	350792-1	N.C.	-180[b]	-479[b]	-12[b]											Volts
A3A1J6	350786-1	-180[b]	-180[b]	—	—											Volts
A3A1J8	350792-1	-666[b]	0	+15[a]	-28[a]											Volts
MODEL 1106E/1106E-L/1206E																
A3A1J3	350430-1	+22[a]	+6	0	0											Volts
A3A1J4	350786-1	-229[b]	N.C.	—	—											Volts
A3A1J5	350792-1	N.C.	-120[b]	-471[b]	-21[b]											Volts
A3A1J6	350786-1	-119[b]	-119[b]	—	—											Volts
A3A1J8	350792-1	-630[b]	0	+28[a]	-15[a]											Volts

Note: a. Varies from klystron to klystron.
b. Varies from klystron to klystron with frequency.
c. Measures taken at 2.00 GHz
d. Connect Fluke Model 8000A Differential Voltmeter Common Lead to Pin 2 of A3A1J8.
e. MODULATION SELECTOR switch in CW position.

TABLE 5-1. VOLTAGE AND RESISTANCE MEASUREMENTS

SYMBOL	PART NO.	PIN NUMBERS 1 (E)	2 (B)	3 (C)	4	5	6	7	8	9	10	11	12	13	14	
HIGH VOLTAGE CONTROL BOARD ASSEMBLY																
A4BR1	MDA970-1	25(3)	0(–)													Ohms
		+23.3	0													Volts
A4Q1	2N4402	0.3K	1.2K	15K												Ohms
		+30.1	+29.9	+7.4												Volts
A4Q2	MJE3055T	15	200	45												Ohms
		+2.0	+2.6	+10.1												Volts
A4Q3	MJE3055T	45	250	35												Ohms
		+10.0	+10.6	+32.0												Volts
A4Q4	MJE3055T	0.3K	1.3K	1K												Ohms
		+30.4	+31.2	+32.3												Volts
A4Q5	2N5190	600	450	100												Ohms
		+31.2	+31.8	+32.3												Volts
A4U1	SN7255P	0	15	8	7	3.5K	2.5K	2.5K	7							Ohms
		0	+11.7	0	+11.7	+7.8	0	0	+11.7							Volts
A4U2	MC78M20	12(1)	1.5K(0)	0(G)												Ohms
		+29.8	+19.9	0												Volts
A4U3	SN72723L	0	4K	3K	3.5K	0	3K	0.3K	0.3K	3.5K	7K					Ohms
		0	+7.4	+7.4	+7.4	0	+11.6	+29.8	+29.8	+12.6	0					Volts
HIGH VOLTAGE BOX ASSEMBLY																
A5Q1	2N5988	15	4	0												Ohms
		+32.0	+32.6	0												Volts
A5Q2	2N5988	15	4	0												Ohms
		+32.0	+32.6	0												Volts
A5A2U1	SN7241L	2K	3.5K	6K	0.4K	2K	3.5K	2.5K	∞							Ohms
		Do not attempt voltage measurements as high voltages are present.														

Note: 1. Measurements taken with Fluke Model 8000A Differential Voltmeter and Triplett Model 630A Voltmeter.
2. – COMMON lead attached to chassis GND.
3. MODULATION SELECTOR switch in CW position.

SECTION VI

PARTS LIST

6-1. INTRODUCTION

6-2. This parts list provides an alpha-numerical listing in reference symbol sequence of the replaceable electrical, certain electro-mechanical, and mechanical parts of the unit.

6-3. **ORDERING INFORMATION.** Orders for parts should contain the following information:

a. Equipment name and model number.
b. Serial number
c. Reference symbol of part, if applicable.
d. Manufacturer's part number and code.

6-4. HOW TO USE THE PARTS LIST

6-5. An explanation of the structure of the parts list, table 6-2, and the meaning of the entries in the five columns are given in the following paragraphs. (See figure 6-1.)

6-6. **REFERENCE SYMBOL COLUMN.** The reference symbol column (1, figure 6-1) contains the reference symbol number assigned to each part, which also identifies the part on the schematic diagram or illustration. The listing is in alpha-numerical order.

6-7. **DESCRIPTION COLUMN.** The description column (2) contains a brief description of each part.

6-8. **MANUFACTURER'S PART NUMBER COLUMN.** The manufacturer's part number column (3) contains the part number assigned by the manufacturer of the part.

6-9. **MANUFACTURER'S CODE COLUMN.** The manufacturer's code column (4) contains a five digit code identifying the manufacturer of the part. Table 6-1 contains a listing of the five digit codes and the manufacturer's names and addresses.

6-10. **QUANTITY COLUMN.** The quantity column (5) indicates the quantity of each part contained in the respective assembly or subassembly of the instrument.

1 2 3 4 5

TABLE 6-2. PARTS LIST

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	QTY
1A1	HARMONIC GENERATOR	B169999	82199	1
1A2R6	RESISTOR,FIXED,COMPOSITION,1K,5%,½W	RC20GF102J	81349	2
1A2R7	SAME AS 1A2R6			

Figure 6-1. Parts List Example

TABLE 6-1. MANUFACTURER'S CODE

Code	Name and Address
00779	AMP Inc. Harrisburg, Pa. 17105
01121	Allen Bradley Co. Milwaukee, Wisc. 53204
01295	Texas Instruments Inc. Semiconductor and Components Div. Dallas, Texas 75231
04713	Motorola Semiconductor Products, Inc. Phoenix, Arizona 85008
09214	General Electric Co. Semi-Conductor Products Dept. Auburn, N.Y. 31022
09353	C & K Components, Inc. Newton, Mass. 02158
12697	Clarostat Mfg. Co. Dover, N.H. 03820
13715	Fairchild Camera and Instrument Corp. Semiconductor Div. San Rafael, Calif. 94902
14099	Semtech Corp. Newbury Park, Calif. 91320
14655	Cornell-Dubilier Electric Co. Newark, N.J. 07105
16727	Condensor Products Corp. Brooksville, Fla. 33512
19112	Garry Manufacturing Co. New Brunswick, N.J. 08902
37942	P. R. Mallory and Co. Indianapolis, Ind. 46206
49671	RCA Corp. New York, N.Y. 10020
56289	Sprague Electric Co. North Adams, Mass. 01247
63472	Ward Leonard Electric Co. Mt. Vernon, N.Y. 10550
71590	Centralab Div. Globe Union, Inc. Milwaukee, Wisc. 53201
72982	Erie Technological Products, Inc. Erie, Pa. 16512
73138	Beckman Instruments, Inc. Helipot Div. Fullerton, Calif. 92634
73445	Amperex Electronic Corp. Hicksville, N.Y. 11801
75042	IRC Div. of TRW Inc. Philadelphia, Pa. 19108
75915	Littelfuse, Inc. Des Plaines, Ill. 60016
80294	Bourns, Inc. Riverside, Calif. 95207
81312	Winchester Electronics Div. Oakville, Conn.
81349	Military Specifications
82199	Polarad Electronics Corp. Lake Success, N.Y. 11040
82389	Switchcraft, Inc. Chicago, Ill. 60630
83701	Electronic Devices, Inc. Yonkers, N.Y. 10710
92702	IMC Magnetics Corp. Westbury, N.Y. 11591
99999	Wilbrecht Electronics St. Paul, Minn. 55107

TABLE 6-2. PARTS LIST

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	QTY
	MODELS 1105E/1106E/1105E-L/1106E-L SIGNAL GENERATORS MODELS 1205E and 1206E SIGNAL GENERATORS			
A1	**AC BOX ASSEMBLY**	**C161442**	**82199**	**1**
A1F1	FUSE, CARTRIDGE	31301.5	75915	1
A1J1	CONNECTOR, RECEPTACLE	EAC-301	82389	1
A1J2	CONNECTOR, RECEPTACLE	M4S-LRN	81312	2
A1J3	SAME AS A1J2			
A1S1	SWITCH, ROTARY	20BE	71590	1
A1S2	SWITCH, SLIDE	46206LF1	82389	1
A1XF1	FUSEHOLDER	A161897	82199	1
A2	**POWER TRANSFORMER ASSEMBLY**	**C161454**	**82199**	**1**
A2P2	CONNECTOR, PLUG	M4P-LSH10	81312	1
A2P3	CONNECTOR, PLUG	C162119-1	82199	1
A2P4	CONNECTOR, PLUG	C162119-2	82199	1
A2P5	CONNECTOR, PLUG	C162119-3	82119	1
A2T1	TRANSFORMER, POWER	C161312	82199	1
A3	**PUSHBUTTON BOARD ASSEMBLY**	**D161606-1**	**82199**	**1**
A3A1	**PUSHBUTTON BOARD COMPONENT ASSEMBLY**	**C161608-4**	**82199**	**1**
A3A1BR1	RECTIFIER, BRIDGE	MDA-970-1	04713	1
A3A1C1	CAPACITOR, ELECTROLYTIC, 1000 UUF, 16 WVDC	503D-108G016ER	56289	3
A3A1C2	CAPACITOR, MYLAR, 0.1 UF, 10%, 100 VDCW	PMG1000-2A	73445	1
A3A1C3	CAPACITOR, ELECTROLYTIC, 330 UUF, 50 VDCW	VTT330UF,50V	37942	1
A3A1C4	CAPACITOR, ELECTROLYTIC, 25 UF, 50 VDCW	30D256G0.50CC0	56289	1
A3A1C5	SAME AS A3A1C1			
A3A1C6 THRU A3A1C8	NOT USED			
A3A1C9	CAPACITOR, CERAMIC, 330 UUF, 100 VDCW	DD-331	14655	1
A3A1C10	NOT USED			
A3A1C11	CAPACITOR, PAPER, 0.25 UF, 2K VDCW	B161743	82199	2
A3A1C12	SAME AS A3A1C11			
A3A1C13	CAPACITOR, MYLAR, 0.05 UF, 1600 VDCW	16PS-S50	56289	1
A3A1C14	CAPACITOR, CERAMIC, 0.001 UF, 100 VDCW	DD-102	14655	1
A3A1C15	CAPACITOR, CERAMIC, 47 UUF	DD-470	14655	1
A3A1C16	SAME AS A3A1C1			
A3A1C17	CAPACITOR, MYLAR, 0.01 UF, 1%, 100 VDCW	663-UW,1%	84411	1
A3A1C18	CAPACITOR, FILM, 0.01 UF	PMG-1001-A	73445	2
A3A1C19	SAME AS C18			
A3A1C20	CAPACITOR, CERAMIC, 0.01 UF, 600 VDCW	811-000-Z540-103M	72982	1
A3A1C21 THRU A3A1C24	NOT USED			

TABLE 6-2. PARTS LIST (Continued)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	QTY
A3A1C25	CAPACITOR, CERAMIC, 22 PF	DD30-220	14655	1
A3A1C26	NOT USED			
A3A1C27	CAPACITOR, CERAMIC, 0.05 UF, +80% -20%	DD-503	14655	1
A3A1CR1	SEMICONDUCTOR DEVICE, DIODE	1N4742A	81349	1
A3A1CR2	SEMICONDUCTOR DEVICE, DIODE	1N456	81349	2
A3A1CR3	SAME AS A1A3CR2			
A3A1CR4	SEMICONDUCTOR DEVICE, DIODE	CG-3F	14099	2
A3A1CR5	SEMICONDUCTOR DEVICE, DIODE	1N4759A	81349	2
A3A1CR6	SAME AS A3A1CR5			
A3A1CR7	SEMICONDUCTOR DEVICE, DIODE	1N914	81349	1
A3A1CR8	SEMICONDUCTOR DEVICE, DIODE	1N5382B	81349	3
A3A1CR9 AND A3A1CR10	SAME AS A3A1CR8			
A3A1CR11	SEMICONDUCTOR DEVICE, DIODE	1N4751A	81349	1
A3A1CR12	SEMICONDUCTOR DEVICE, DIODE	1N4762A	81349	1
A3A1CR13	SAME AS A3A1CR4			
A3A1J1	CONNECTOR, RECEPTACLE	C162191-1	82199	1
A3A1J2	CONNECTOR, RECEPTACLE	C162191-2	82199	1
A3A1J3	CONNECTOR, RECEPTACLE	C162191-12	82199	1
A3A1J4	CONNECTOR, RECEPTACLE	C162191-6	82199	1
A3A1J5	CONNECTOR, RECEPTACLE	C162191-9	82199	1
A3A1J6	CONNECTOR, RECEPTACLE	C162191-7	82199	1
A3A1J7	CONNECTOR, RECEPTACLE	C162191-8	82199	1
A3A1J8	CONNECTOR, RECEPTACLE	C162191-4	82199	1
A3A1L1	CHOKE	A161462	82199	3
A3A1L2, L3	SAME AS A3A1L1			
A3A1Q1	TRANSISTOR	D40D7	09214	1
A3A1Q2	TRANSISTOR	2N5415	81349	2
A3A1Q3	SAME AS A3A1Q2			
A3A1R1	RESISTOR, VARIABLE, 5K	72P5KOHM	73138	1
A3A1R2	RESISTOR, COMPOSITION, 100K, 5%, ½W	RC20GF104J	81349	4
A3A1R3	RESISTOR, COMPOSITION, 1 MEG, 5%, ½W	RC20GF105J	81349	5
A3A1R4	NOT USED			
A3A1R5	NOT USED			
A3A1R6	SAME AS A3A1R2			
A3A1R7	SAME AS A3A1R3			
A3A1R8	RESISTOR, COMPOSITION, 1K, 5%, 2W	RC42GF102J	81349	2
A3A1R9	RESISTOR, WW, 1K, 5%, 3W	23J1K0	44655	1
A3A1R10	NOT USED			
A3A1R11	RESISTOR, COMPOSITION, 470K, 5%, ½W	RC20GF474J	81349	1
A3A1R12	RESISTOR, COMPOSITION, 100K, 5%, 1W	RC32GF104J	81349	1
A3A1R13	SAME AS A3A1R8			
A3A1R14	SAME AS A3A1R3			
A3A1R15	NOT USED			
A3A1R16	NOT USED			

TABLE 6-2. PARTS LIST (Continued)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	QTY
A3A1R17	RESISTOR, VARIABLE, 250K	72P254	73138	1
A3A1R18	RESISTOR, COMPOSITION, 270K, 5%, ½W	RC20GF274J	81349	1
A3A1R19 THRU A3A1R22	NOT USED			
A3A1R23	RESISTOR, COMPOSITION, 10K, 5%, ½W	RC20GF103J	81349	2
A3A1R24	SAME AS A3A1R3			
A3A1R25	NOT USED			
A3A1R26	SAME AS A3A1R2			
A3A1R27	NOT USED			
A3A1R28	SAME AS A3A1R3			
A3A1R29	RESISTOR, COMPOSITION, 220K, 5%, ½W	RC20GF224J	81349	1
A3A1R30	NOT USED			
A3A1R31	RESISTOR, VARIABLE, 5K, 5%, ½W	3339H-1-502	80294	1
A3A1R32	SAME AS A3A1R23			
A3A1R33	RESISTOR, COMPOSITION, 47K, 5%, 2W	RC42GF473J	81349	1
A3A1R34	RESISTOR, FILM, 10K, 1%, ½W	RN65C1002F	81349	1
A3A1R35	NOT USED			
A3A1R36	NOT USED			
A3A1R37	RESISTOR, FILM, 26.1K, 1%, ½W	RN65C2612F	81349	1
A3A1R38 THRU A3A1R40	NOT USED			
A3A1R41	RESISTOR, COMPOSITION, 620 OHMS, 5%, ½W	RC20GF621J	81349	1
A3A1R42	RESISTOR, VARIABLE, 200K, 5%, ½W	3339-H-L-204	80294	1
A3A1R43	SAME AS A3A1R2			
A3A1R44	RESISTOR, COMPOSITION, 1K, 5%, ½W	RC20GF102J	81349	1
A3A1R45	RESISTOR, COMPOSITION, 39K, 5%, ½W	RC20GF393J	81349	1
A3A1R46	RESISTOR, COMPOSITION, 100K, 5%, 2W	RC42GF104J	81349	1
A3A1R51	RESISTOR, COMPOSITION, 3.9K, 5%, ½W	RC20GF392J	81349	1
A3A1R52	RESISTOR, COMPOSITION, 15K, 5%, ½W	RC20GF153J	81349	1
A3A1R53	RESISTOR, COMPOSITION, 2.7 MEG, 5%, 1W	RC32GF275J	81349	1
A3A1U1	INTEGRATED CIRCUIT	UA78-GUIC	13715	1
A3A1U2	INTEGRATED CIRCUIT	40014P	13715	1
A3A1U3	INTEGRATED CIRCUIT	CD4013AE	49671	1
A3A1U4	INTEGRATED CIRCUIT	SN7255P	01295	1
A3A2	**CAPACITOR BOARD ASSEMBLY**	**B161453-2**	**82199**	**1**
A3A2C1 THRU A3A2C21	NOT USED			
A3A2C22	CAPACITOR, ELECTROLYTIC, 12 UF, 450 VDCW	WBR-12-450	00686	1
A3A2C28	CAPACITOR, MYLAR, 1 UF, 1K VDCW	KM9-10-1M	56289	1

TABLE 6-2. PARTS LIST (Continued)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	QTY
A3A2R1 THRU A3A2R35	NOT USED			
A3A2R36	RESISTOR, VARIABLE, 10K, 5%, 2W	70D1N048F103W	01121	1
A3A2R37	NOT USED			
A3A2R38A/B	RESISTOR, VARIABLE, 25K, 5%, 2W	70D1N048F253W	01121	1
A3A2R39 THRU A3A2R46	NOT USED			
A3A2R47	RESISTOR, COMPOSITION, 270K, 5%, 1W	RC32GF274J	81349	1
A3A3	**PUSHBUTTON BRACKET ASSEMBLY**	**B161495**	**82199**	**1**
A3A3R4	RESISTOR, VARIABLE, 100K, 5%, 2W	70D1N056F104W	01121	2
A3A3R16	SAME AS A3A3R4			
A3S1	SWITCH, PUSHBUTTON	A161316	82199	1
A4	**HIGH VOLTAGE CONTROL BOARD**	C161321-4	**82199**	**1**
A4BR1	BRIDGE, RECTIFIER	MDA970-1	04713	1
A4C1	CAPACITOR, ELECTROLYTIC, 5800 UF, 40 VDCW	86F556M1	01002	1
A4C2	CAPACITOR, ELECTROLYTIC, 470 UF, 50 VDCW	503D-477G050ET	56289	2
A4C3	SAME AS A4C2			
A4C4	CAPACITOR, ELECTROLYTIC, 100 UF, 16 VDCW	503D-107G016CD	56289	1
A4C5	NOT USED			
A4C6	CAPACITOR, MYLAR, 0.1 UF	C280AE/104	73445	1
A4C7	CAPACITOR, ELECTROLYTIC, 10 UF, 10%, 25 VDCW	162D106X902DD2	56289	1
A4C8	CAPACITOR, ELECTROLYTIC, 10 UF, 25 VDCW	503D106G025AB	56289	1
A4C9	CAPACITOR, ELECTROLYTIC, 22 UF, 25 VDCW	503D226G025AB	56289	1
A4C10	NOT USED			
A4C11	CAPACITOR, MICA, 91 PF, 10%	CM05FD910G03	81349	2
A4C12	SAME AS A4C11			
A4C13	CAPACITOR, ELECTROLYTIC, 1000 UF, 6.3 VDCW	503D108G6R3DK	562891	1
A4C14	CAPACITOR, ELECTROLYTIC, 470 UF, 6.3 VDCW	503D477G6R3CG	56289	1
A4CR1	SEMICONDUCTOR DEVICE, DIODE	1N456	81349	3
A4CR2	SAME AS A4CR1			
A4CR3	SAME AS A4CR1			
A4CR4	SEMICONDUCTOR DEVICE, DIODE	1N4742A	81349	1
A4F1	FUSE, CARTRIDGE, 2.5 AMP	31202.5	75915	1
A4F2	FUSE, CARTRIDGE, ¼ AMP	312.250	75915	1
A4J1	CONNECTOR, RECEPTACLE	C162191-3	82199	1
A4J2	CONNECTOR, RECEPTACLE	C162191-5	82199	1
A4J3	CONNECTOR, RECEPTACLE	C162191-8	82199	1
A4Q1	TRANSISTOR	2N4402	81349	1
A4Q2	TRANSISTOR	MJE3055T	04713	3
A4Q3	SAME AS A4Q2			
A4Q4	SAME AS A4Q2			
A4Q5	TRANSISTOR	2N5190	81349	1
A4R1	RESISTOR, FILMS, 0.2 OHMS, 1%, 2W	AS-2B	75042	1
A4R2	RESISTOR, COMPOSITION, 15 OHMS, 5%, 1W	RC32GF150J	81349	1

TABLE 6-2. PARTS LIST (Continued)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	QTY
A4R3	RESISTOR, COMPOSITION, 200 OHMS, 5%, ½W	RC20GF201J	81349	1
A4R4	RESISTOR, VARIABLE, 500 OHMS	3339H-1-501	80294	1
A4R5	NOT USED			
A4R6	RESISTOR, COMPOSITION, 10K, 5%, ½W	RC20GF103J	81349	4
A4R7	RESISTOR, COMPOSITION, 1.2K, 5%, ½W	RC20GF122J	81349	1
A4R8	RESISTOR, WW, 180 OHMS, 5%, 5W	5XM180	63742	1
A4R9	RESISTOR, COMPOSITION, 1K, 5%, ½W	RC20GF102J	81349	5
A4R10	RESISTOR, COMPOSITION, 270 OHMS, 5%, ½W	RC20GF271J	81349	1
A4R11	SAME AS A4R6			
A4R12	SAME AS A4R6			
A4R13	RESISTOR, COMPOSITION, 4.7 MEG, 5%, ½W	RC207GF475J	81349	1
A4R14	SAME AS A4R9			
A4R15	RESISTOR, COMPOSITION, 100K, 5%, ½W	RC20GF104J	81349	1
A4R16	RESISTOR, COMPOSITION, 3.9K, 5%, ½W	RC20GF392J	81349	1
A4R17	RESISTOR, COMPOSITION, 470 OHMS, 5%, ½W	RC20GF471J	81349	1
A4R18	RESISTOR, FILM, 10K, 1%, ½W	RN65C1002F	81349	2
A4R19	SAME AS A4R18			
A4R20	SAME AS A4R9			
A4R21	RESISTOR, VARIABLE, 1K	3339H-1-102	80294	1
A4R22	RESISTOR, FILM, 5.62K, 1%, ½W	RN65C5621F	81349	1
A4R23	RESISTOR, COMPOSITION, 150 OHMS, 5%, ½W	RC20GF150J	81349	1
A4R24	SAME AS A4R6			
A4R25	SAME AS A4R9			
A4R26	NOT USED			
A4R27	NOT USED			
A4R28	RESISTOR, COMPOSITION, 2K, 5%, ½W	RC20GF202J	81349	1
A4TP	CONNECTOR, RECEPTACLE	C162191-13	82199	1
A4U1	INTEGRATED CIRCUIT	SN72555P	01295	1
A4U2	INTEGRATED CIRCUIT	MC78M20CP	04713	1
A4U3	INTEGRATED CIRCUIT	SN72723L	01295	1
A5	**HIGH VOLTAGE BOX**	**D161309-1**	**82199**	**1**
A5A1	**HV GENERATOR COMPONENT ASSEMBLY**	**A161443-1**	**82199**	**1**
A5A1BR1	RECTIFIER, BRIDGE	MDA-920A-3	04713	1
A5A1C1	NOT USED			
A5A1C2	NOT USED			
A5A1C3 THRU A5A1C8	NOT USED			
A5A1C9	CAPACITOR, ELECTROLYTIC, 470 UF, 50 VDCW	503D4770G0	56289	1
A5A1C10	NOT USED			
A5A1C11	NOT USED			
A5A1C12	CAPACITOR, ELECTROLYTIC, 100 UF, 16 VDCW	503D107G0	56289	1
A5A1C13	NOT USED			
A5A1C14	CAPACITOR, ELECTROLYTIC, 12 UF, 450 VDCW	WBR12-450	14655	1

TABLE 6-2. PARTS LIST (Continued)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	QTY
A5A1CR1 THRU A5A1CR8	NOT USED			
A5A1CR9	SEMICONDUCTOR DEVICE, DIODE	SH30F	14099	4
A5A1CR10	SAME AS A5A1CR9			
A5A1CR11	SAME AS A5A1CR9			
A5A1CR12	SAME AS A5A1CR9			
A5A1R1 THRU A5A1R7	NOT USED			
A5A1R8	RESISTOR, WW, 100 OHMS, 1%, 3W	300S, 100 OHMS	83125	1
A5A1R9	NOT USED			
A5A1R10	RESISTOR, COMPOSITION, 270K, 5%, 1W	RC32GF244J	81349	1
A5A2	**MASTER OSCILLATOR COMPONENT ASSEMBLY**	**B161444**	**82199**	**1**
A5A2C1	CAPACITOR, ELECTROLYTIC, 470 UF, 50 VDCW	503D-477G0	56289	2
A5A2C2	CAPACITOR, ELECTROLYTIC, 0.1 UF, 10%, 1KV	10PS-P10	56289	1
A5A2C3 THRU A5A2C9	NOT USED			
A5A2C10	SAME AS A5A2C1			
A5A2C11	CAPACITOR, ELECTROLYTIC, 0.05 UF, 10%, 1.6 KV	16PS-P10	56289	1
A5A2CR1	SEMICONDUCTOR DEVICE, DIODE	1N5364B	81349	5
A5A2CR2	SMAE AS A5A2CR1			
A5A2CR3	SAME AS A5A2CR1			
A5A2CR4	SAME AS A5A2CR1			
A5A2CR5	SEMICONDUCTOR DEVICE, DIODE	SH30F	14099	4
A5A2CR6	SAME AS A5A2CR5			
A5A2CR7	SAME AS A5A2CR5			
A5A2CR8	SAME AS A5A2CR5			
A5A2CR9 THRU A5A2CR12	NOT USED			
A5A2CR13	SEMICONDUCTOR DEVICE, DIODE	1N456	81349	3
A5A2CR14	SAME AS A5A2CR13			
A5A2CR15	SAME AS A5A2CR1			
A5A2CR16	SAME AS A5A2CR13			
A5A2R1 THRU A5A2R3	NOT USED			
A5A2R4	RESISTOR, COMPOSITION, 470 OHMS, 5%, ½W	RC20GF471J	81349	1
A5A2R5	RESISTOR, VARIABLE, 20K	3339H-1-203	80294	1
A5A2R6	RESISTOR, WW, 470 OHMS, 5%, 3W	VC3D.470,5%	12697	1
A5A2R7	RESISTOR, FILM, 261K, 1%, 1W	RN75C2613F	81349	1
A5A2T1	TRANSFORMER	B161314	82199	1
A5A2U1	INTEGRATED CIRCUIT	SN72741L	01295	1

TABLE 6-2. PARTS LIST (Continued)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	QTY
A5Q1	TRANSISTOR	2N5988	81349	2
A5Q2	SAME AS A5Q1			
A5T2	TRANSFORMER	C161313	82199	1
A5W11	CABLE ASSEMBLY	B161490	82199	1
A5W12	CABLE ASSEMBLY	B161491	82199	1
A6	**TRACKING BOARD**	**B161587**	**82199**	**1**
A6J1	CONNECTOR, PLUG	C162191-10	82199	1
A6J2	CONNECTOR, PLUG	C162191-5	82199	1
A6R1	RESISTOR, VARIABLE, 50K, 2W	70N5L040S503W	01121	2
A6R2	SAME AS A6R1			
A6R3	RESISTOR, VARIABLE, 100K, 2W	70N5L040S104W	01121	2
A6R4	SAME AS A6R3			
A6R5	RESISTOR, COMPOSITION, 47K, 5%, 2W	RC42GF473J	81349	1
A6R6	RESISTOR, COMPOSITION, 22K, 5%, 1W	RC32GF223J	81349	1
A7	**TUNING HEAD ASSEMBLY (1105E)**	**E161666**	**82199**	**1**
A7	**TUNING HEAD ASSEMBLY (1106E)**	**E160136**	**82199**	**1**
A7	**TUNING HEAD ASSEMBLY (1105E-L)**	**E161666**	**82199**	**1**
A7	**TUNING HEAD ASSEMBLY (1106E-L)**	**E160136**	**82199**	**1**
A7	**TUNING HEAD ASSEMBLY (1205E)**	**E160402**	**82199**	**1**
A7	**TUNING HEAD ASSEMBLY (1206E)**	**E161669**	**82199**	**1**
A7R81	RESISTOR, VARIABLE, 100K, 1%, 9W	B162345-1	82199	1
A7S4	SWITCH, SENSITIVE	AN4234-1	81349	1
A7S5	SAME AS A7S1 (1105E-L, 1106E-L ONLY)			
A8	**METER ASSEMBLY**	**B161311**	**82199**	**1**
A8M1	METER	A710282-1	82199	1
A11	**LEVEL STABILIZER BOARD ASSEMBLY (MODELS 1105E-L, 1106E-L ONLY)**	**C161673**	**82199**	**1**
A11BR1	RECTIFIER, BRIDGE	MDA920-1	04713	1
A11C1	CAPACITOR, ELECTROLYTIC, 100 UF, 10%, 16 WVDC	503D107G106NB	56289	5
A11C2	SAME AS A11C1			
A11C3	SAME AS A11C1			
A11C4	SAME AS A11C1			
A11C5	NOT USED			
A11C6	CAPACITOR, ELECTROLYTIC, 22 UF, -10 + 75%, 16 VDCW	VTT22A16	37492	2
A11C7	SAME AS A11C6			
A11C8	CAPACITOR, MICA, 51PF, 5%, 500 VDCW	CM04ED510JP3	81349	2
A11C9	CAPACITOR, CERAMIC, 3.3 UF, 10%, 15 VDCW	196D335X9015JA1	56289	2
A11C10	SAME AS A11C9			
A11C11	CAPACITOR, CERAMIC, 0.1 UF, 10%, 50 VDCW	8121-050-X7R0-104K	72982	1
A11C12	SAME AS A11C1			

TABLE 6-2. PARTS LIST (Continued)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	QTY
A11C13	SAME AS A11C8			
A11CR1	SEMICONDUCTOR DEVICE, DIODE	1N34A	81349	1
A11CR2	SEMICONDUCTOR DEVICE, DIODE	1N456	81349	1
A11DS1	LIGHT, INDICATOR	EL41-2-0-820-A	99999	1
A11J1	CONNECTOR, RECEPTACLE	102-14CCB-LL "G"	19112	1
A11P7	CONNECTOR, PLUG	1480698-0	00779	1
A11P9	CONNECTOR, PLUG	87499-9	00779	1
A11Q1	TRANSISTOR	2N4402	81349	1
A11Q2	TRANSISTOR	2N3638	81349	1
A11Q3	TRANSISTOR	2N4400	81349	1
A11R1	RESISTOR, COMPOSITION, 430 OHMS, 5%, ¼W	RC07GF431J	81349	1
A11R2	RESISTOR, FILM, 10K, 1%, 1/8W	RN55D1002F	81349	2
A11R3	SAME AS A11R2			
A11R4	RESISTOR, COMPOSITION, 100K, 5%, ¼W	RC07GF101J	81349	2
A11R5	RESISTOR, FILM, 49.9K, 1%, 1/8W	RN55D49R9F	81349	1
A11R6	RESISTOR, FILM, 15K, 1%, 1/8W	RN55D1502F	81349	1
A11R7	RESISTOR, COMPOSITION' 5.1K, 5%, ¼W	RC07GF512J	81349	1
A11R8	RESISTOR, COMPOSITION, 470K, 5%, ¼W	RC07GF474J	81349	1
A11R9	RESISTOR, VARIABLE, 5K, 10%	3339H-1-502	80294	1
A11R10	RESISTOR, COMPOSITION, 47M, 5%, ¼W	RC07GF476J	81349	1
A11R11	RESISTOR, COMPOSITION, 1.5K, 5%, ¼W	RC07GF152J	81349	1
A11R12	RESISTOR, VARIABLE, 2K, 10%	3339H-1-202	80294	1
A11R13	RESISTOR, COMPOSITION, 150K, 5%, ¼W	RC07GF154J	81349	2
A11R14	RESISTOR, VARIABLE, 10K, 10%	70NIH056P103W	01121	1
A11R15	RESISTOR, COMPOSITION, 680K, 5%, ¼W	RC07GF681J	81349	1
A11R16	RESISTOR, COMPOSITION, 1.2K, 5%, ½W	RC20GF122J	81349	1
A11R17	RESISTOR, COMPOSITION, 1K, 5%, ¼W	RC07GF102J	81349	1
A11R18	RESISTOR, COMPOSITION, 100K, 5%, ¼W	RC07GF104J	81349	1
A11R19	RESISTOR, COMPOSITION, 10K, 5%, ¼W	RC07GF103J	81349	1
A11R20	SAME AS A11R4			
A11R21	RESISTOR, COMPOSITION, 2.7K, 5%, ¼W	RC07GF272J	81349	1
A11R22	RESISTOR, VARIABLE, 1K, 10%	3339H-1-102	80294	1
A11R23	RESISTOR, VARIABLE, 10K, 10%	3339H-1-103	80294	1
A11R24	SAME AS A11R13	RC07GF151J	81349	1
A11S1	SWITCH	7201-P3-D9-A-B	09353	1
A11U1	INTEGRATED CIRCUIT	UA78L82AWC	13715	1
A11U2	INTEGRATED CIRCUIT	UA747	13715	1
A11U3	INTEGRATED CIRCUIT	UA702	13715	1
A11U4	INTEGRATED CIRCUIT	CA3130T	49671	1
AT1, AT2	PIN ATTENUATOR (1105E-L)	E160156-1	82199	2
AT1, AT2	PIN ATTENUATOR (1106E-L)	D160350	82199	2
B1	FAN	W52107FL	92702	1
C1	CAPACITOR, CERAMIC, 0.0047 UF, 3 KV	60GAD47	56289	1
DS1	LAMP	1050C3	91802	1
J1	CONNECTOR, RECEPTACLE	B161509	82199	3
J2, J3	SAME AS J1			

TABLE 6-2. PARTS LIST (Continued)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	QTY
J8	SAME AS J1 (1105E-L, 1106E-L ONLY)	B61509	82199	1
J9	SAME AS J1 (1105E-L, 1106E-L W/OPTION V ONLY)	B161509	82199	1
V1	KLYSTRON (1105E, 1105E-L, 1205E)	A160047	82199	1
V1	KLYSTRON (1106E, 1106E-L)	A160036	82199	1
V1	KLYSTRON (1206E)	A160037	82199	1
W1	CABLE ASSEMBLY	B161507	82199	1
W7	KLYSTRON COVER ASSEMBLY	C161718	82199	1
W8	CABLE ASSEMBLY (1105E, 1106E)	B161503	82199	1
W9	CABLE ASSEMBLY (1105E)	C161343	82199	1
W9	CABLE ASSEMBLY (1106E)	B160702	82199	1
W10	TERMINAL BOARD CABLE ASSEMBLY	B161497	82199	1
W10TB1	TERMINAL BOARD	A710390	82199	1
W13	CABLE ASSEMBLY	B161701	82199	1
W14	CABLE AND PROBE ASSEMBLY (1105E, 1105E-L, 1205E)	A150648	82199	1
W14	CABLE AND PROBE ASSEMBLY (1106E, 1106E-L, 1206E)	A150649	82199	1
W15	CABLE AND PROBE ASSEMBLY (1105E)	C161340	82199	1
W15	CABLE AND PROBE ASSEMBLY (1106E)	C160701	82199	1
W15	CABLE AND PROBE ASSEMBLY (1205E)	B160386	82199	1
W15	CABLE AND PROBE ASSEMBLY (1206E)	B160387	82199	1
W16	CABLE ASSEMBLY	B161505	82199	1
W25	CABLE ASSEMBLY (1105E-L, 1106E-L)	B160337	82199	1
W26	CABLE ASSEMBLY (1105E-L, 1106E-L)	B160338	82199	1
W27	CABLE ASSEMBLY, POWER SET PROBE (1105E-L)	C162315	82199	1
W27	CABLE ASSEMBLY, POWER SET PROBE (1106E-L)	B160700	82199	1
W28	CABLE ASSEMBLY, RF ATTEN (1105E-L)	C162316	82199	1
W28	CABLE ASSEMBLY, RF ATTEN (1106E-L)	B160699	82199	1
W29	CABLE ASSEMBLY (1105E-L, 1106E-L)	B161719	82199	1
W30	CABLE ASSEMBLY (1105E-L, 1106E-L) W/OPTION V)	B161746	82199	1
Z1	DETECTOR (1105E, 1105E-L)	A160356	82199	1
Z1	DETECTOR (1106E, 1106E-L)	A160357	82199	1

POLARAD ELECTRONICS,INC.

5 Delaware Drive Lake Success,New York 11042 516-328-1100

REQUEST FOR MAINTENANCE

FROM:

COMPANY NAME _____ DATE: _____

ADDRESS: _____ INDIVIDUAL: _____

_____ POSITION: _____

_____ PHONE NO. _____ EXT. _____

_____

SECTION OR DIVISION: _____

EQUIPMENT: _____ DATE OF PURCHASE: _____

MODEL _____ SERIAL NO. _____ ORDER NO. _____

_____

TROUBLE REPORT:

A. Description of trouble _____

_____

_____

_____

_____

_____

B. Has trouble been localized? _____ If so, how and where: _____

_____

_____

_____

_____

_____

C. Instruments used and measurements taken, if any: _____

_____

_____

_____

_____

D. Is trouble intermittent? _____

E. Hours of operation prior to this trouble _____

F. Date troubled occurred _____

G. Was factory consulted by telephone or letter prior to this request? _____

If so, give date and person to whom directed: _____

_____

H. Additional comments: _____

_____

_____

_____

_____

_____

_____

_____

When trouble develops requiring factory assistance, complete this form and send to:

Polarad Electronics, Inc.
5 Delaware Drive
Lake Success, New York 11042
Attn: Service Department

After this report has been analyzed by the Service Department, you will be notified when a field service engineer will call on you to make the necessary repairs. If your trouble can best be corrected at the factory, we will notify you with instructions and authorization for returning the equipment.

NO EQUIPMENT MAY BE RETURNED TO THE FACTORY WITHOUT WRITTEN AUTHORIZATION

Manuals Plus Order Sheet

Name _____ Date_____

Company _____

Address 1 _____

Address 2 _____

City_____ State _____ ZIP _____

Bill to same? _____ If No – Put Billing Address in Notes at bottom

Phone _____ Fax _____

Email _____

SKU	MFG	Model	Type	Part #	Price
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

Shipping Cost: _____

Payment Info

Card # _____ Exp: mm/yy _____

Name on Card _____ CVV _____

PO Number _____ Order Total: _____

Notes: (such as Billing Address, their Shipping Account Number, etc.)

MP MASTER
MA35734